Air Quality Monitoring in the City of Lethbridge
September 1998 to July 1999

Summary

Alberta Environment conducted a mobile air quality survey in the City of Lethbridge on eight days between September 1998 and July 1999. The objectives of the survey were to: (1) determine air quality in Lethbridge; (2) compare the air quality levels to Alberta's air quality guidelines; and (3) compare levels in Lethbridge to other regions in the province. The results of the survey revealed no major air quality issues in Lethbridge based on this monitoring survey. Concentrations of all compounds monitored were below Alberta's Ambient Air Quality Guidelines.

The Alberta Environment *Mobile Air Monitoring Laboratory* (MAML) was used to monitor air quality in Lethbridge at five locations (Downtown, the Fire Hall, Park Meadows, Sportsplex and West Lethbridge). The MAML monitored for carbon monoxide, oxides of nitrogen, ozone, particulates, hydrocarbons, sulphur dioxide, hydrogen sulphide, total reduced sulphur, and ammonia. This report presents air quality levels in Lethbridge for the eight day monitoring period compared to: (1) Alberta's Ambient Air Quality Guidelines; and (2) air quality at other locations in Alberta for the same time period.

Alberta Environment conducts mobile air quality surveys each year as part of its air quality monitoring program. The surveys are unannounced and use the department's Mobile Air Monitoring Laboratory. In 1999, Alberta Environment conducted 14 mobile air quality monitoring surveys within the province.

Findings

No major air quality issues were identified in Lethbridge based on this monitoring survey. Pollutant concentrations were below Alberta's Ambient Air Quality Guidelines. Alberta has one-hour air quality guidelines for carbon monoxide, nitrogen dioxide, ozone, sulphur dioxide, hydrogen sulphide and ammonia. Maximum one-hour concentrations were:

- 18% of the one-hour guideline for carbon monoxide;
- 8% of the one-hour guideline for nitrogen dioxide;
- 76% of the one-hour guideline for ozone;
- 4% of the one-hour guideline for sulphur dioxide;
- 30% of the one-hour guideline for hydrogen sulphide; and
- 1% of the one-hour guideline for ammonia.

Concentrations of chemicals emitted by vehicles including carbon monoxide, oxides of nitrogen and hydrocarbons were generally very low in Lethbridge. The highest levels of these chemicals were recorded at the Fire Hall. The maximum one-hour carbon monoxide and nitrogen dioxide concentrations were 2.4 and 0.016 ppm (parts per million), respectively. These values are well below the one-hour guidelines of 13 and 0.210 ppm for these two parameters, respectively.

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ENVIRONMENT

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Air quality levels measured in Lethbridge were close to those recorded at other Alberta cities with similar populations. For example, the average carbon monoxide concentration in Lethbridge was 0.3 ppm compared to 0.3 ppm in Fort McMurray and 0.5 ppm in Fort Saskatchewan for the same time period. The average nitrogen dioxide value in Lethbridge was 0.004 ppm compared to 0.007 ppm in Fort McMurray and 0.013 ppm in Fort Saskatchewan.

Ozone levels in Lethbridge were similar to those measured at other small urban centres in Alberta. The maximum one-hour ozone concentration recorded in this survey was 0.062 ppm. Maximum ozone concentrations recorded at other rural and small urban locations in Alberta for the same time period ranged from 0.054 to 0.075 ppm. Ozone is present in the background atmosphere due to natural processes such as: (1) transport from the "ozone rich" upper atmosphere, and (2) the reaction of naturally occurring hydrocarbons and oxides of nitrogen in the presence of sunlight to produce ozone.

Alberta's Ambient Air Quality Guidelines

Alberta's Ambient Air Quality Guidelines[1] are established under Section 14 of the Environmental Protection and Enhancement Act (EPEA). EPEA provides for the development of guidelines and ambient environmental quality objectives for all or part of Alberta.

The Ambient Air Quality Guidelines are used in a number of ways:

- reporting on the state of the atmospheric environment in Alberta;
- reporting to Albertans on the quality of air through an air quality index;
- establishing approval conditions for regulated industrial facilities;
- evaluating proposals to construct facilities that will have air emissions;
- guiding special ambient air quality surveys; and
- assessing compliance near major industrial air emission sources.

Alberta's Ambient Air Quality Guidelines for one-hour concentrations of parameters monitored during this survey are indicated as follows:

Air Quality Parameter	One-hour Guideline (ppm*)	Basis for Guideline
hydrogen sulphide	0.01	odour perception
ammonia	2	odour perception
carbon monoxide	13	oxygen carrying capacity of blood
nitrogen dioxide	0.212	odour perception
ozone	0.082	reduction of lung function and effects on tomatoes
sulphur dioxide	0.172	taste, odour perception and effects on bluegrass

* parts per million by volume

Monitoring Method

The Alberta Environment Mobile Air Monitoring Laboratory (MAML) was used to monitor air quality for about 78 hours, over eight days, in Lethbridge between September 1998 and July 1999. The focus of this monitoring was to collect air quality data representative of urban sources in the city, such as vehicle exhaust emissions and industrial sources. Air quality was monitored on the following dates representing the fall, winter, spring and summer seasons:

- fall (September 23 and 24, 1998)
- winter (February 23 and 24, 1999);
- spring (May 11 and 12, 1999); and
- summer (July 19 and 20, 1999).

The MAML monitored air quality at five locations in Lethbridge for a minimum of one hour at each location to allow comparison to the air quality guidelines. Data collected at these locations was

1 Alberta Ambient Air Quality Guidelines. Alberta Environment. February 2000.

compared to other locations in the province for the same time period.

The MAML is a 27-foot (8.2 m) vehicle that has been specially designed and equipped to measure air quality. It houses a variety of instruments that continuously sample the air at specified time or distance intervals.

The MAML is equipped with:

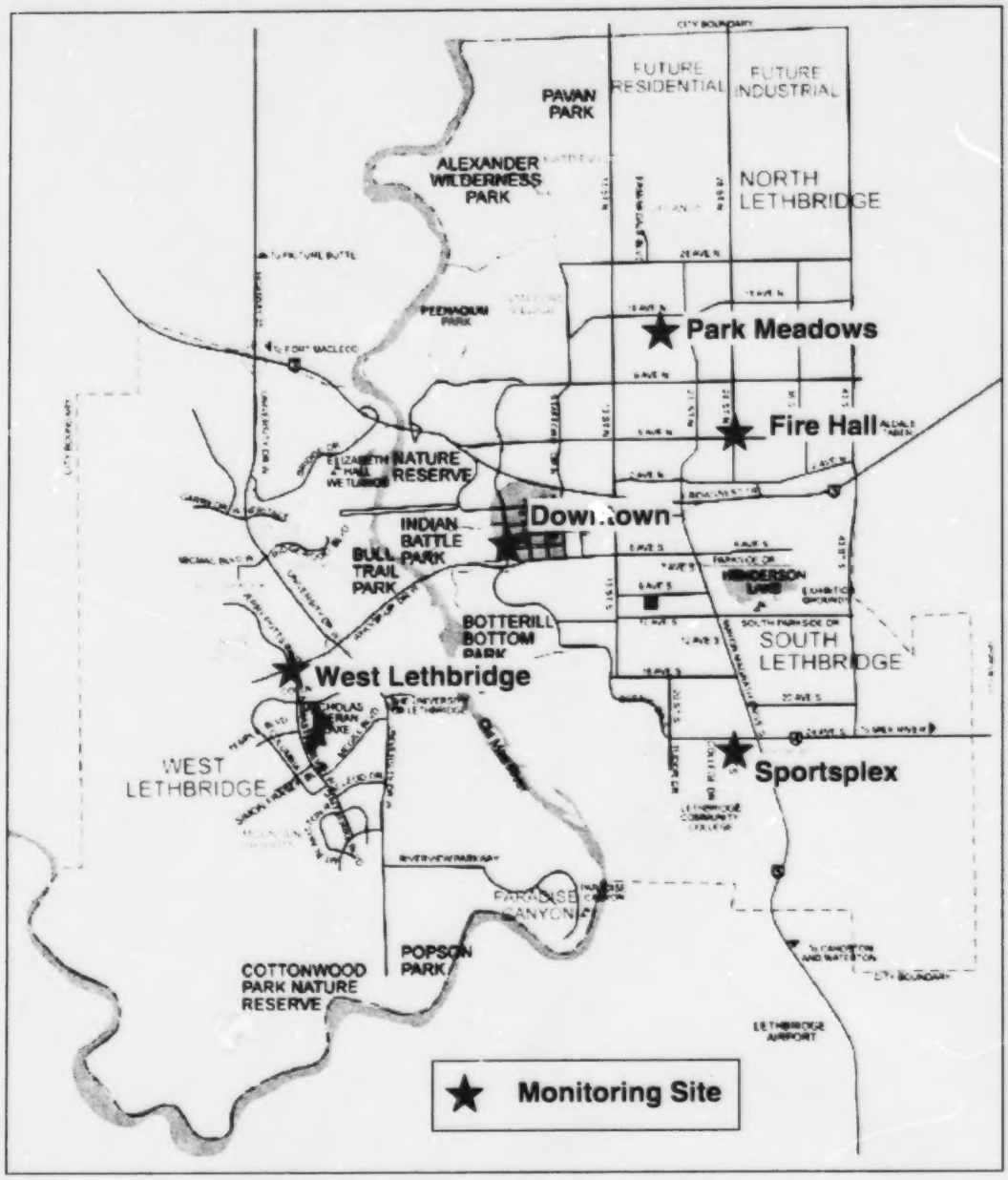
- a dual computer system custom-programmed to control the measurement of air samples from each analyzer;
- a GPS (Global Positioning System) that will identify the MAML's location as it moves around Alberta;
- an exhaust purifying system that minimizes emissions from the vehicle; and
- two on-board generators that are also equipped with exhaust scrubbers.

Alberta Environment 's Mobile Air Monitoring Laboratory (MAML)

The following parameters were measured by the MAML during the Lethbridge survey:

Parameter Measured	Minimum Detectable Limit	Operating Range
Sulphur dioxide (SO_2)	0.6 ppb	1 ppm
Hydrogen sulphide (H_2S)	0.6 ppb	1 ppm
Total reduced sulphur (TRS)	0.6 ppb	1 ppm
Total hydrocarbons (THC)	0.005 ppm	20 ppm
Reactive hydrocarbons (RHC)	0.005 ppm	20 ppm
Methane (CH_4)	0.005 ppm	10 ppm
Polycyclic aromatic hydrocarbons (PAHs)	3 ng/m^3	1000 ng/m^3
Ozone (O_3)	0.001 ppm	0.5 ppm
Nitrogen dioxide (NO_2)	1.0 ppb	1 ppm
Nitric oxide (NO)	1.0 ppb	1 ppm
Total oxides of nitrogen (NO_x)	1.0 ppb	1 ppm
Total suspended particulates (TSP)	1 $\mu g/m^3$	1.0 g/m^3
Inhalable particulates (PM_{10})	1 $\mu g/m^3$	1.0 g/m^3
Respirable particulates ($PM_{2.5}$)	1 $\mu g/m^3$	1.0 g/m^3
Carbon monoxide (CO)	0.1 ppm	50 ppm
Ammonia (NH_3)	1.0 ppb	2 ppm
Wind direction (WDR)	0 degrees	360 degrees
Wind speed (WSP)	0 kph	200 kph
Temperature (Temp)	-40 °C	50 °C
Relative humidity (RH)	0 %	100 %

ppb = parts per billion
ng/m^3 = nanograms per cubic metre
$\mu g/m^3$ = micrograms per cubic metre
°C = degrees Celsius
ppm = parts per million
g/m^3 = grams per cubic metre
kph = kilometres per hour
% = per cent



Downtown	**4 Ave. S and Scenic Dr. S**
Fire Hall	**5 Ave. N and 28 St. N**
Park Meadows	**15 Ave. N and 18 St. N**
Sportsplex	**28 Ave. S and 24 St. S**
West Lethbridge	**Whoop Up Dr. and McMaster Blvd.**

Location of Monitoring Sites in the City of Lethbridge

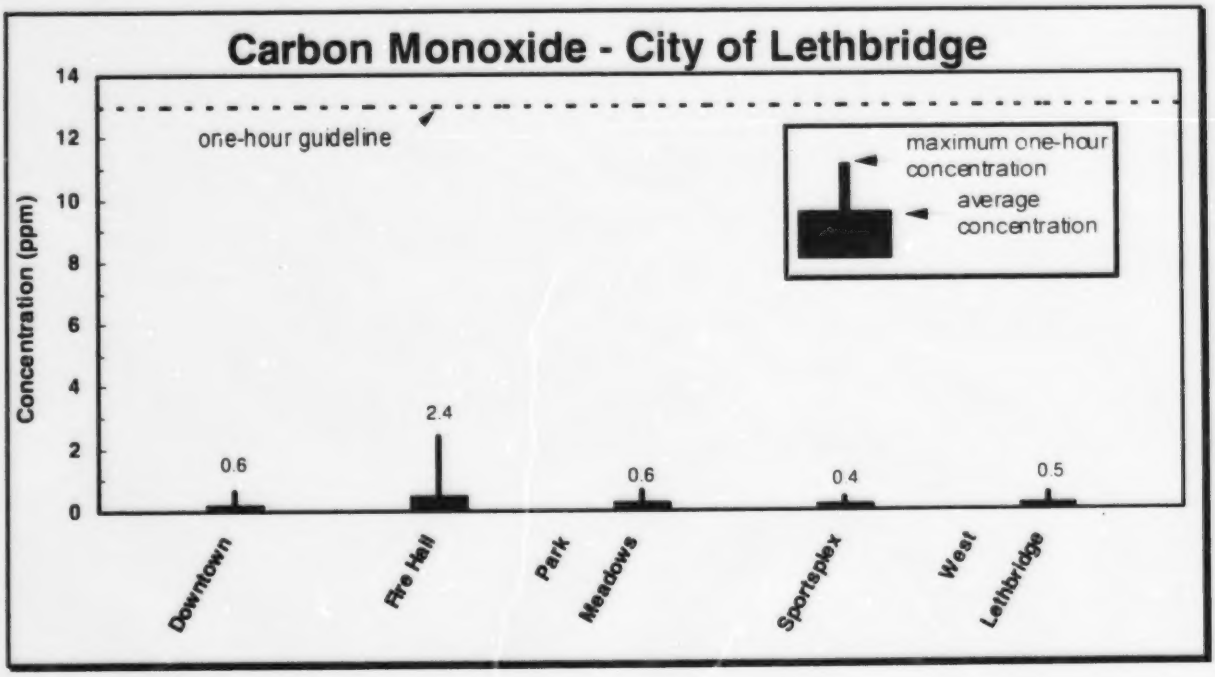
Carbon Monoxide (CO)

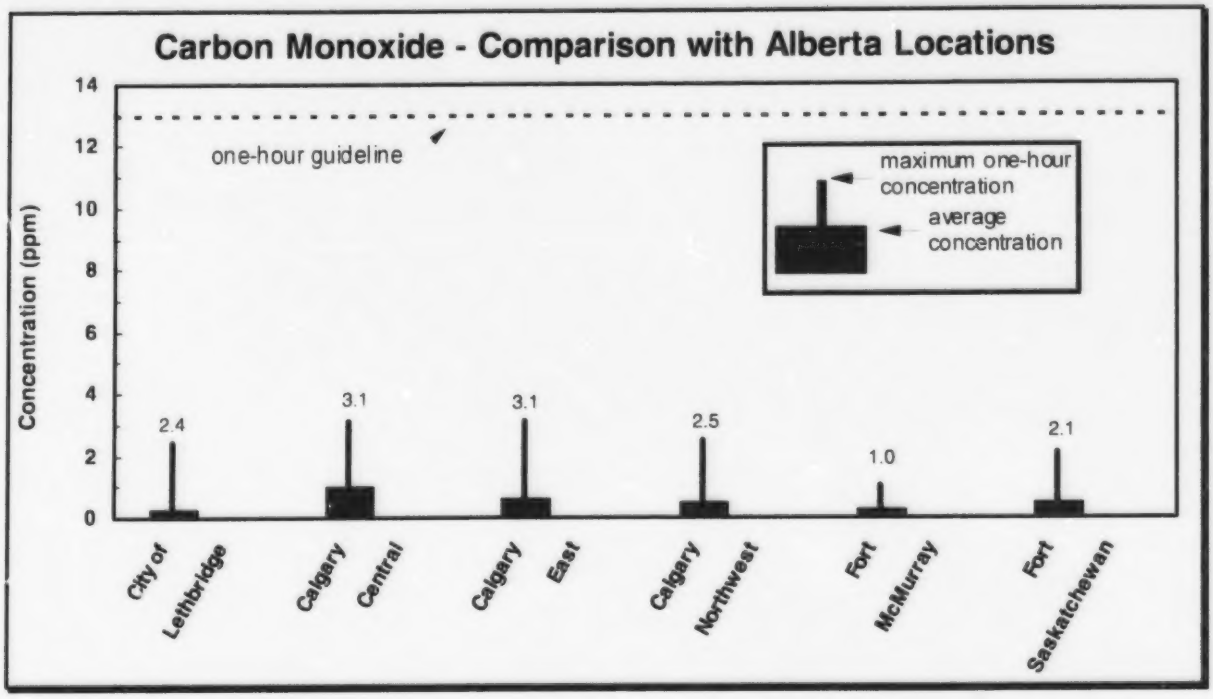
max. one-hour concentration measured during survey	one-hour guideline
2.4 ppm	13 ppm

Carbon monoxide (CO) is a colourless, odourless gas emitted into the atmosphere primarily by motor vehicles. Minor sources include fireplaces, industry, aircraft and natural gas combustion. The major source of carbon monoxide in Lethbridge is vehicle exhaust emissions.

CO values were generally low during the entire survey period in the City of Lethbridge. The maximum one-hour concentration of 2.4 ppm was recorded at the Fire Hall site on the morning of September 24. This maximum value is 18% of the one-hour guideline. CO concentrations were low (0.6 ppm or lower) at the other Lethbridge monitoring sties during this survey.

The average CO concentration measured during the Lethbridge survey (0.3 ppm) was the same as the average CO value recorded in Fort McMurray and lower than those measured in Calgary and Fort Saskatchewan for the same time period. Average CO levels at the Calgary and Fort Saskatchewan monitoring stations ranged from 0.5 to 1.0 ppm for the same monitoring period. The maximum one-hour CO values measured in the Lethbridge survey were also lower than those measured at Calgary monitoring stations. The maximum one-hour average CO concentration in the Lethbridge survey was 2.4 ppm compared to 2.5 to 3.1 ppm recorded at the Calgary stations. As mentioned earlier, the major source of CO in Lethbridge is vehicle exhaust emissions.





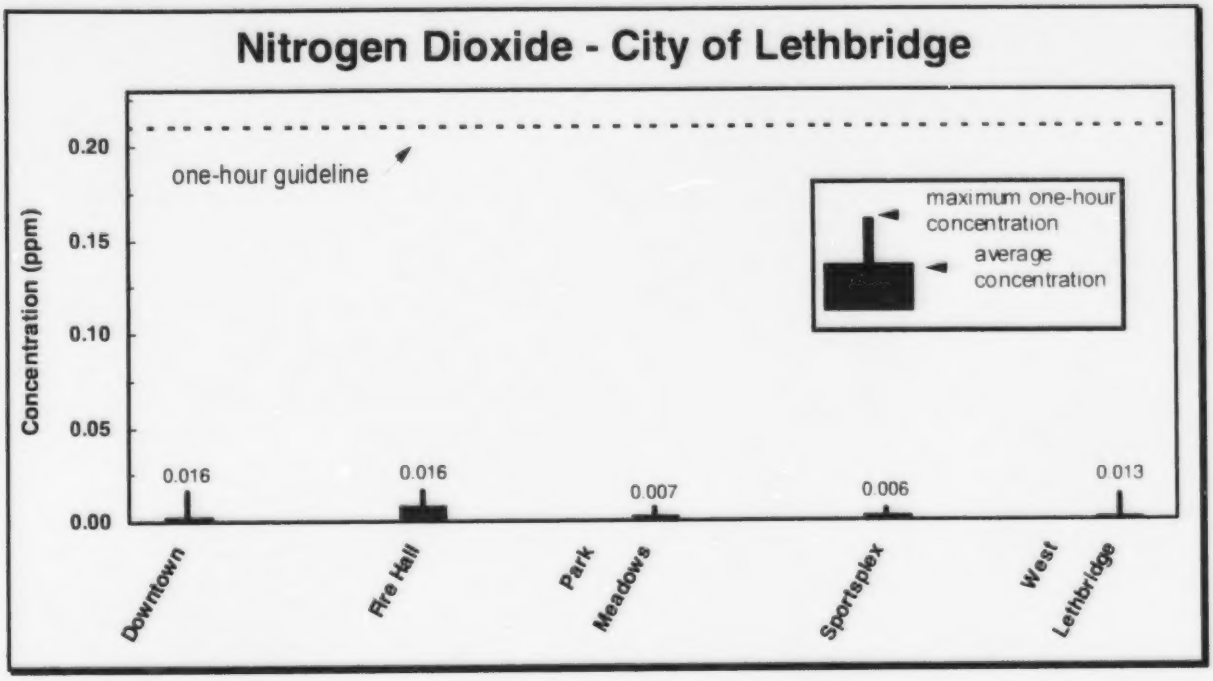
Oxides of Nitrogen (NO_2, NO, NO_x)

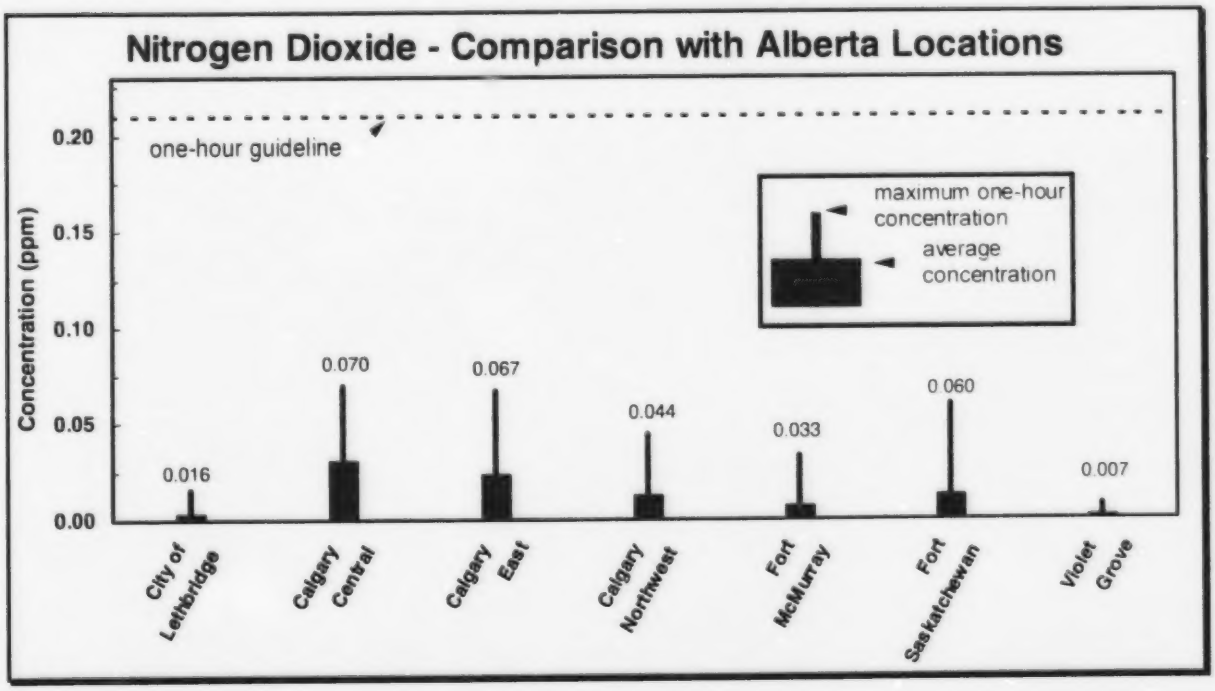
max. one-hour concentration measured during survey	one-hour guideline
NO_2 = 0.016 ppm	0.210 ppm
NO = 0.026 ppm	no guideline
NO_x = 0.042 ppm	no guideline

Oxides of nitrogen (NO_x) are the total of nitrogen dioxide (NO_2) and nitric oxide (NO). During high temperature combustion - as in the burning of natural gas, coal, oil and gasoline - atmospheric nitrogen may combine with molecular oxygen to form NO. NO is colourless and odourless. Most NO in the ambient air is oxidized to form NO_2. NO_2 is a reddish-brown gas with a pungent odour. The major source of oxides of nitrogen in urban areas is vehicle exhaust emissions. Processes associated with the oil and gas industry also emit oxides of nitrogen into the atmosphere.

The maximum one-hour average NO_2 concentration (0.016 ppm) was recorded at the Fire Hall site on the morning of February 24 and at the Downtown site on the evening of September 24. This maximum value is 8% of the one-hour guideline for NO_2. Maximum one-hour average NO_2 concentrations at the other monitoring locations ranged 0.006 to 0.013 ppm. The highest NO and NO_x concentrations (0.026 and 0.042 ppm) were also measured at the Fire Hall site on February 24. Oxides of nitrogen measured at the Fire Hall site on February 24 were caused by smoke from burning a substance consisting of vegetable oil during a smoke course at the Fire Hall. The overall average NO_2 concentration at the six sites ranged between 0.002 ppm at the West Lethbridge site to 0.008 ppm at the Fire Hall site.

Average oxides of nitrogen concentrations recorded in the Lethbridge study were substantially lower than those recorded in Calgary for the same monitoring period. The overall average NO_2 concentration in Lethbridge was 0.004 ppm, compared to a range of 0.013 to 0.031 ppm at the three Calgary monitoring stations. NO_2 values in Lethbridge were also lower than those measured in Fort McMurray (0.007 ppm) and Fort Saskatchewan (0.013 ppm) for the same time period. The primary source of oxides of nitrogen in Lethbridge is vehicle exhaust emissions.


Nitrogen Dioxide - City of Lethbridge
Concentration (ppm)
0.20
0.15
0.10
0.05
0.00
one-hour guideline
maximum one-hour concentration
average concentration
0.016
0.016
0.007
0.006
0.013
Downtown
Fire Hall
Park Meadows
Sportsplex
West Lethbridge


Nitrogen Dioxide - Comparison with Alberta Locations
Concentration (ppm)
0.20
0.15
0.10
0.05
0.00
one-hour guideline
maximum one-hour concentration
average concentration
0.016
0.070
0.067
0.044
0.033
0.060
0.007
City of Lethbridge
Calgary Central
Calgary East
Calgary Northwest
Fort McMurray
Fort Saskatchewan
Violet Grove

Ozone (O_3)

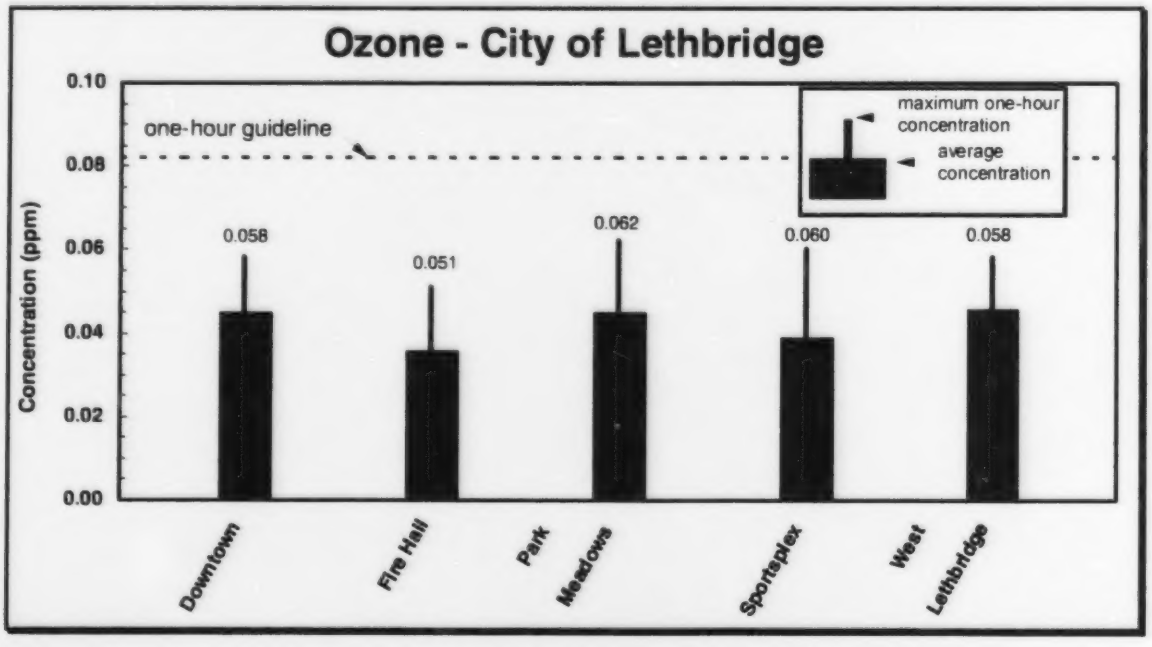
max. one-hour concentration measured during survey	one-hour guideline
0.062 ppm	0.082 ppm

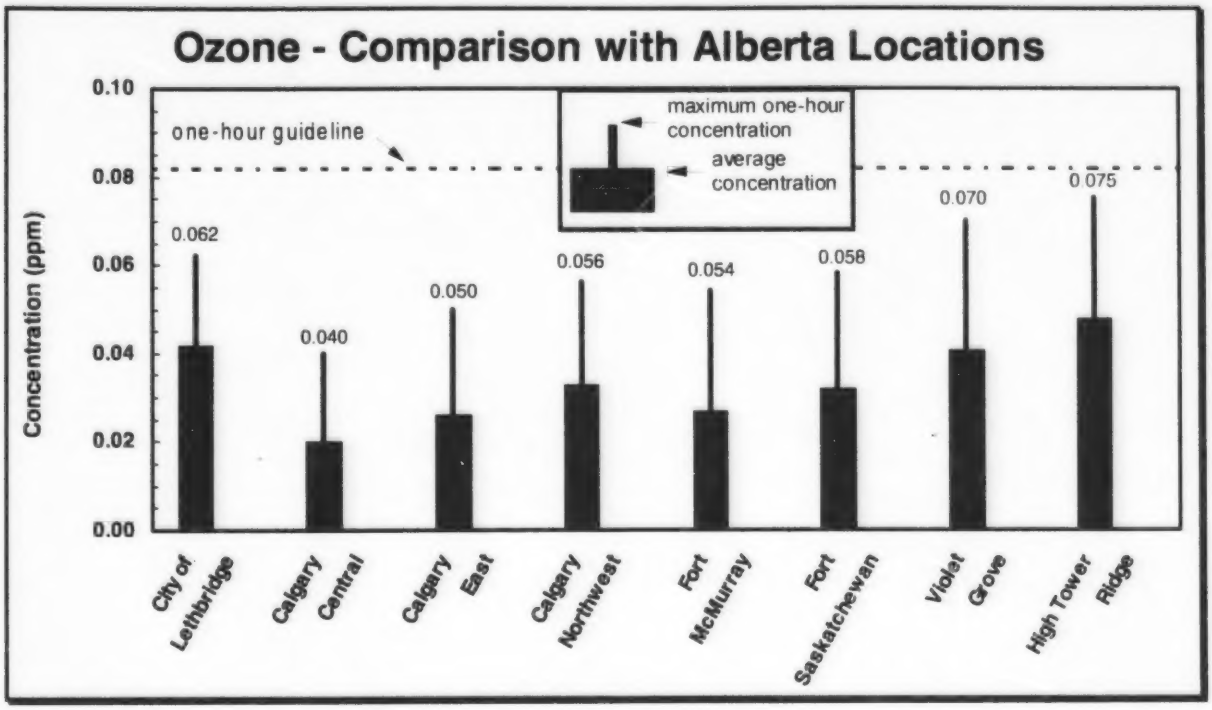
Ozone in the lower atmosphere is produced by: (1) the reaction of oxides of nitrogen and volatile organic compounds in the presence of sunlight, and (2) transport of O_3 from the upper atmosphere to ground level. Transport from the upper atmosphere is likely the dominant ozone producing process in the fall, winter and early spring seasons. O_3 concentrations are generally lower in urban centres due to the destruction of O_3 by nitric oxide.

O_3 concentrations in Lethbridge followed typical daily and seasonal variations. The highest O_3 concentrations are generally detected in the late afternoon of the spring and summer seasons. In this survey, the maximum one-hour average O_3 concentration (0.062 ppm) was recorded in the afternoon of May 11 at the Park Meadows monitoring site. This maximum concentration is 76% of the one-hour guideline for O_3. Maximum one-hour O_3 concentrations ranged from 0.051 to 0.060 ppm at the other five monitoring sites.

Overall average O_3 concentrations ranged from 0.036 ppm at the Fire Hall site to 0.046 ppm at the Downtown and West Lethbridge sites. Overall average ozone levels at the Fire Hall, Sportsplex and Park Meadows sites were 0.036, 0.039 and 0.045 ppm, respectively.

O_3 concentrations in Lethbridge were similar to those recorded at rural locations in Alberta. The average O_3 value in Lethbridge was 0.042 ppm, which is similar to the value recorded at the Violet Grove station (located 10 km southwest of Drayton Valley), and lower than the value recorded at the High Tower Ridge monitoring station (located 65 km west-northwest of Hinton). Average O_3 values at these two stations were 0.041 and 0.048 ppm, respectively, for the same monitoring period. The Violet Grove and High Tower Ridge stations are good indicators of rural and background O_3 levels in Alberta. O_3 values in Lethbridge were higher than those recorded at the Alberta Environment stations located in Calgary, Fort McMurray and Fort Saskatchewan where concentrations ranged from 0.020 to 0.033 ppm for the same time period. As mentioned earlier, O_3 concentrations are generally lower at urban locations because of the destruction of natural O_3 by nitric oxide emitted by vehicles. O_3 is present in the natural environment because of: (1) transport from the "ozone rich" upper atmosphere; and (2) the reaction of naturally occurring hydrocarbons and oxides of nitrogen in the presence of sunlight to produce ozone.





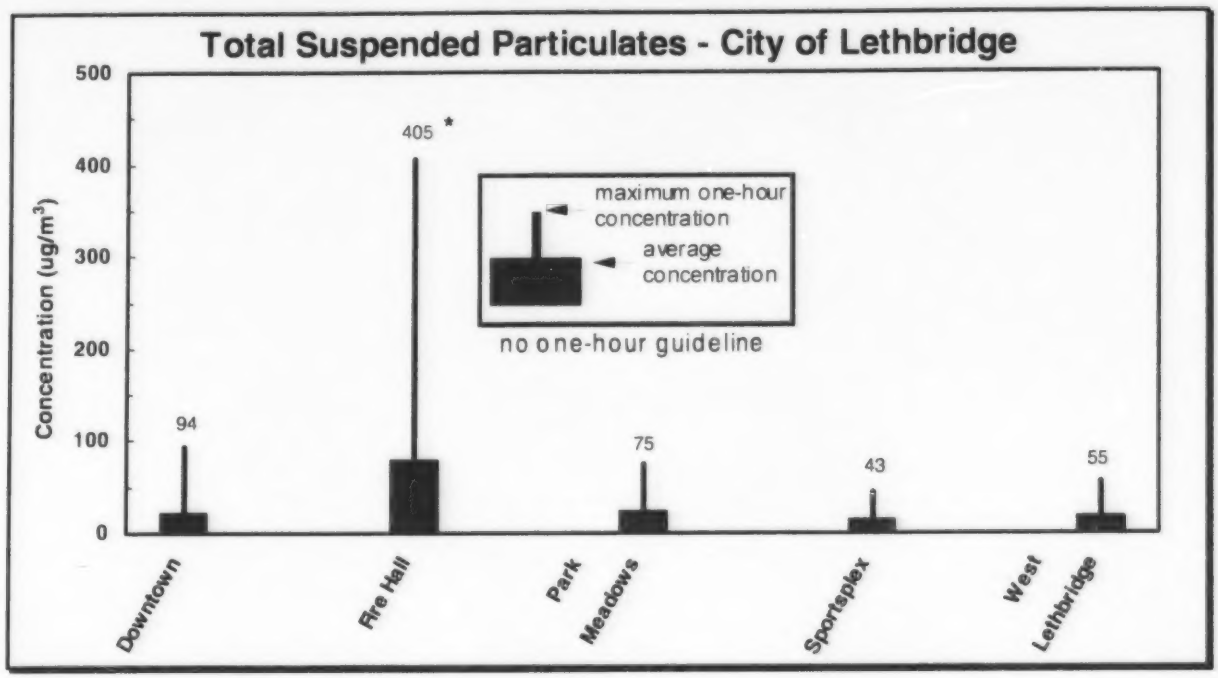
Particulates (TSP, PM_{10} and $PM_{2.5}$)

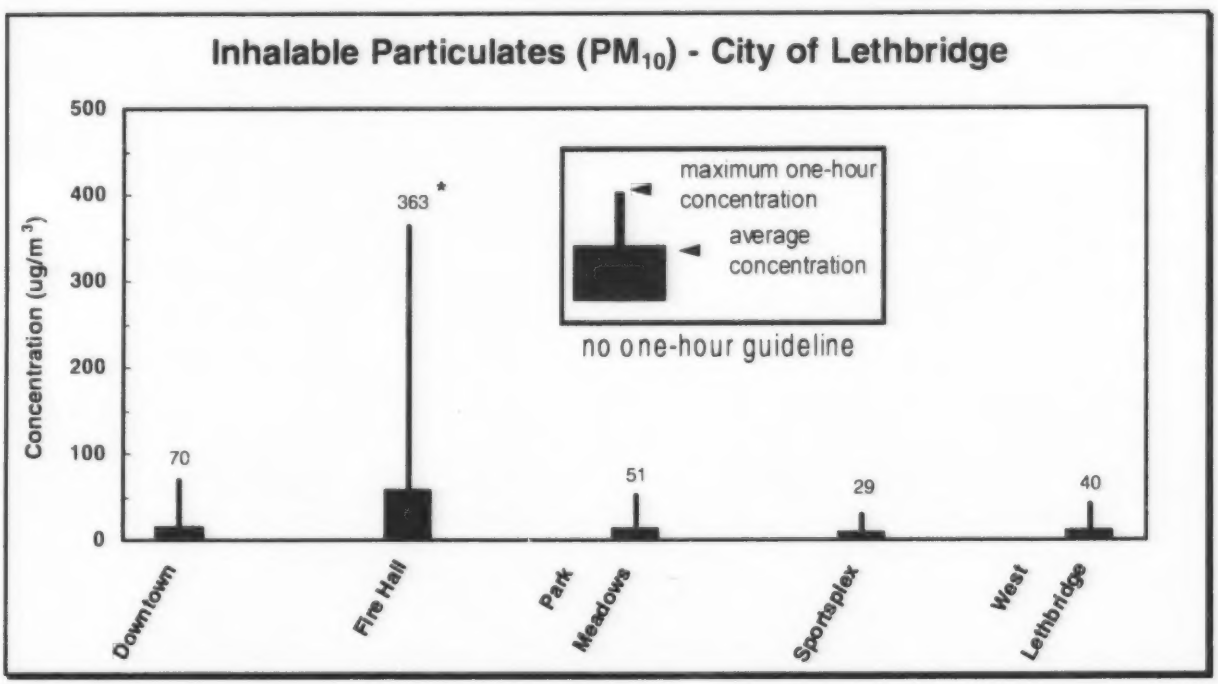
max. one-hour concentration measured during survey	one-hour guideline
TSP = 405 µg/m^3	no guideline
PM_{10} = 363 µg/m^3	no guideline
$PM_{2.5}$ = 294 µg/m^3	no guideline

Air pollutants are not necessarily in a gaseous form. Tiny particles of solid material or liquid droplets, defined collectively as particulates are also present in the atmosphere. Total suspended particulates (TSP) refer to all particles up to 500 microns in diameter (a human hair is about 100 microns in diameter) and are important primarily from a nuisance perspective. Particles less than 10 microns in diameter (PM_{10}) can be inhaled into the nose and throat while smaller particles, less than 2.5 microns in diameter ($PM_{2.5}$), can penetrate into the lungs. Sources of particulates include soil dust, road dust, agricultural dust (e.g., harvest), smoke from forest fires and recreational wood burning, vehicle exhaust emissions, brake and tire wear, and industrial emissions. Smaller particles ($PM_{2.5}$) originate in the atmosphere because of condensation and combustion from sources such as vehicle exhaust emissions, industrial emissions and wood burning.

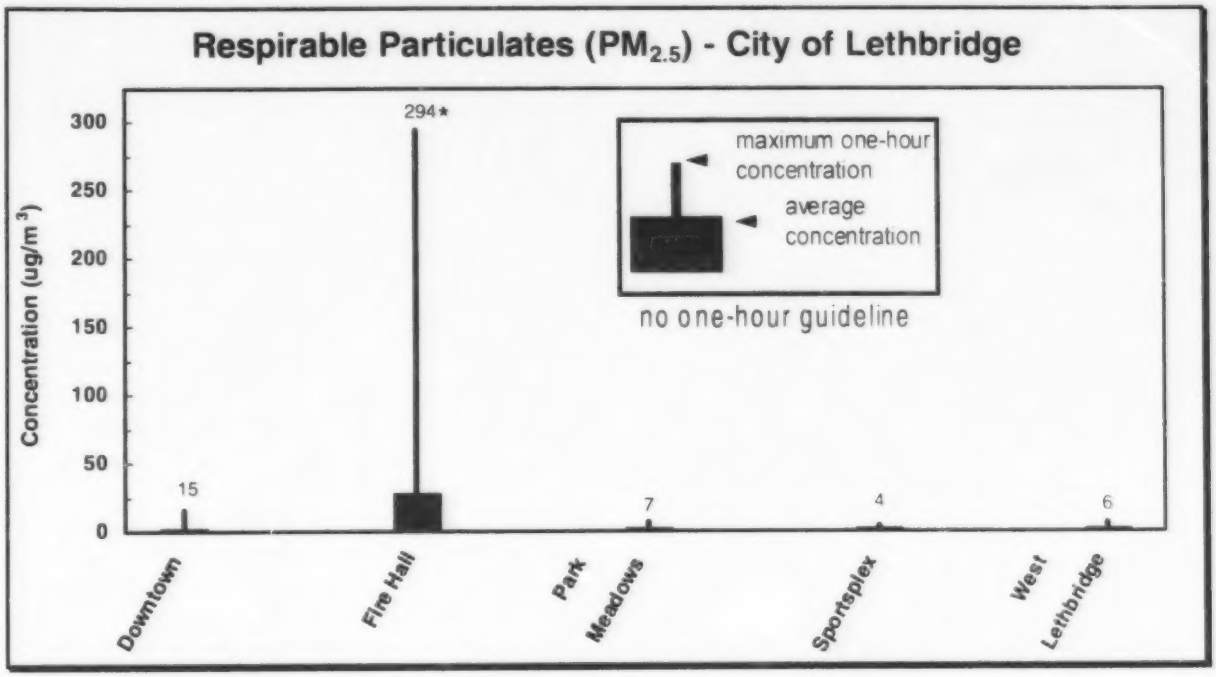
Alberta Environment monitored for TSP, PM_{10} and $PM_{2.5}$ during the Lethbridge survey. The highest one-hour average particulate concentration was observed at the Fire Hall monitoring site from 9:46 a.m. to 10:50 a.m. (M.S.T.) on February 24. TSP, PM_{10} and $PM_{2.5}$ concentrations were 405, 363 and 294 µg/m^3, respectively, during this time period. Particulate matter at this location was caused by a smoke course being conducted at the Fire Hall.

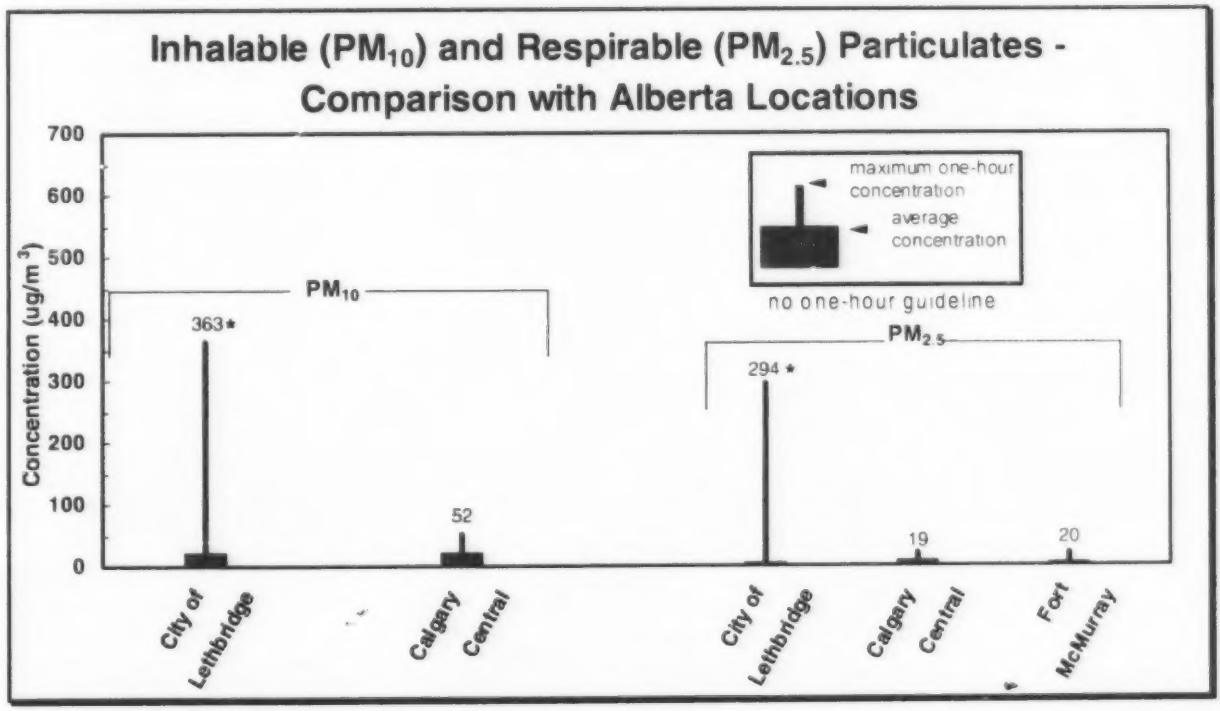
The average PM_{10} concentration recorded during the Lethbridge survey was the same as that recorded in downtown Calgary. The overall average PM_{10} concentration recorded in Lethbridge and at the Calgary Central monitoring station was 23 µg/m^3. However, the average PM_{10} concentration in Lethbridge is biased upward because of the high particulate values measured during the smoke course at the Fire Hall. The overall average $PM_{2.5}$ concentration was 7 µg/m^3 in Lethbridge, compared to 10 µg/m^3 at the Calgary Central station and 7 µg/m^3 at the Fort McMurray monitoring station for the same time period.





* Elevated particulate concentration due to smoke course conducted at the Fire Hall.





* Elevated particulate concentration due to smoke course conducted at the Fire Hall.

Hydrocarbons (THC, RHC and CH_4)

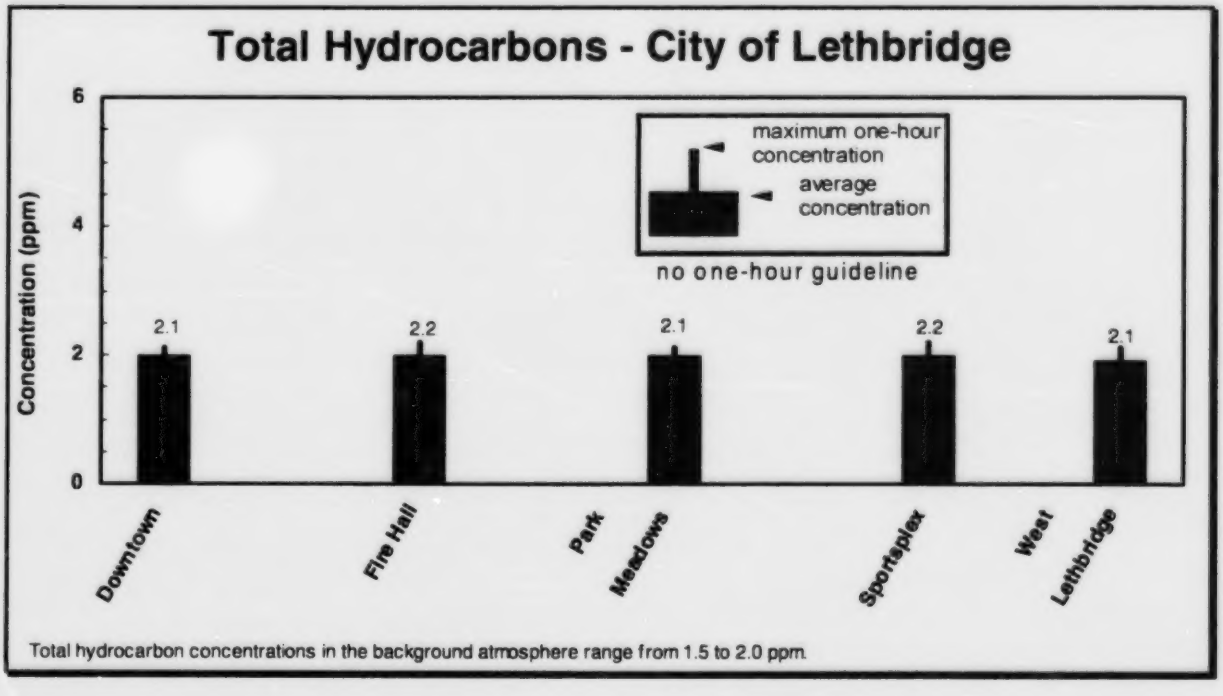
max. one-hour concentration measured during survey	one-hour guideline
THC = 2.2 ppm RHC = 0.4 ppm CH_4 = 1.9 ppm	no guideline no guideline no guideline

The term "total hydrocarbons" (THC) refers to a broad family of chemicals that contain carbon and hydrogen atoms. Methane (CH_4), a non-reactive hydrocarbon, is the most common hydrocarbon in the earth's atmosphere. Specific reactive hydrocarbons (RHC) are important because: (1) they can react with oxides of nitrogen in the presence of sunlight to form ozone; and (2) they can be toxic (at high concentrations) to humans, animals or vegetation. Sources of hydrocarbons include vegetation, vehicle emissions, gasoline marketing and storage tanks, petroleum and chemical industries, dry cleaning, fireplaces, natural gas combustion and aircraft traffic.

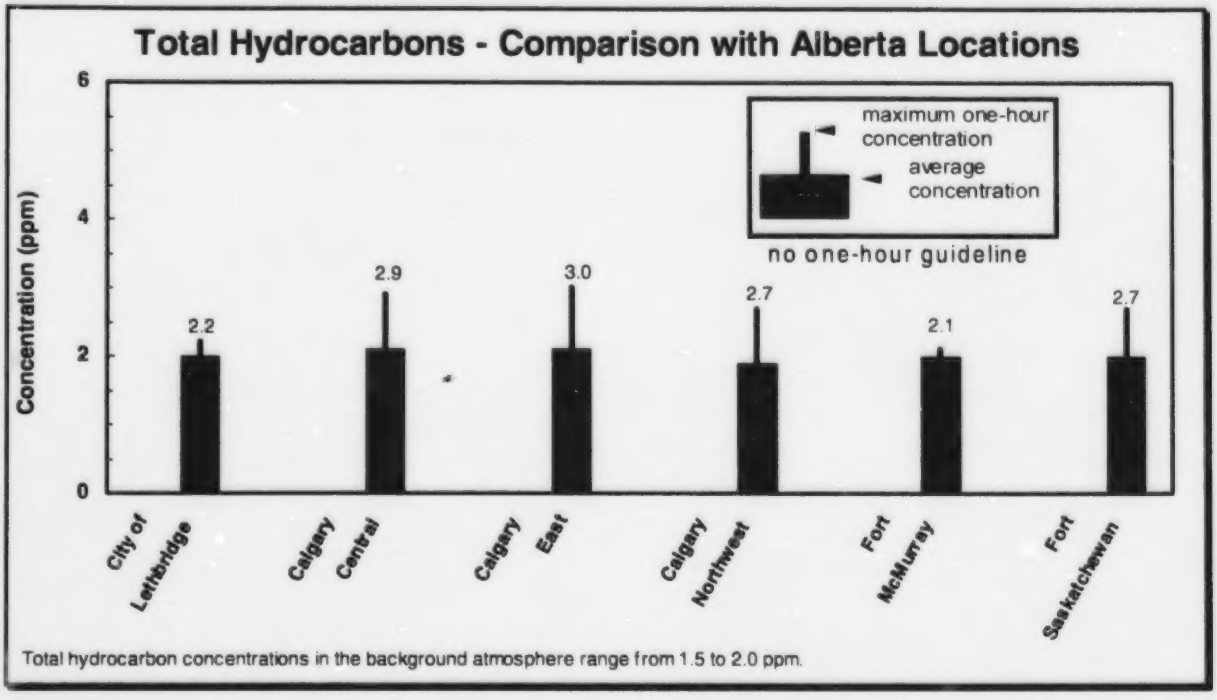
Hydrocarbon levels measured in Lethbridge were generally close to background levels recorded in rural Alberta. The highest THC concentration (2.2 ppm) was measured at the Fire Hall on February 24 during the smoke course. Normal background THC concentrations recorded in rural Alberta range from 1.5 to 2.0 ppm.

Overall average hydrocarbon concentrations were consistent at all five monitoring sites in Lethbridge. The average THC concentrations at all sites were between 1.9 and 2.0 ppm. Average reactive hydrocarbon (RHC) concentrations were 0.2 ppm at all five monitoring sites for the entire monitoring period.

Hydrocarbon concentrations in the Lethbridge study were similar to hydrocarbon values at other monitoring locations in Alberta. The overall average THC concentration in the Lethbridge study was 2.0 ppm. THC values for the same monitoring period at other Alberta locations ranged from 1.8 ppm at the Fort Saskatchewan station to 2.1 ppm at the Calgary Central and Calgary East monitoring stations.



Total hydrocarbon concentrations in the background atmosphere range from 1.5 to 2.0 ppm.



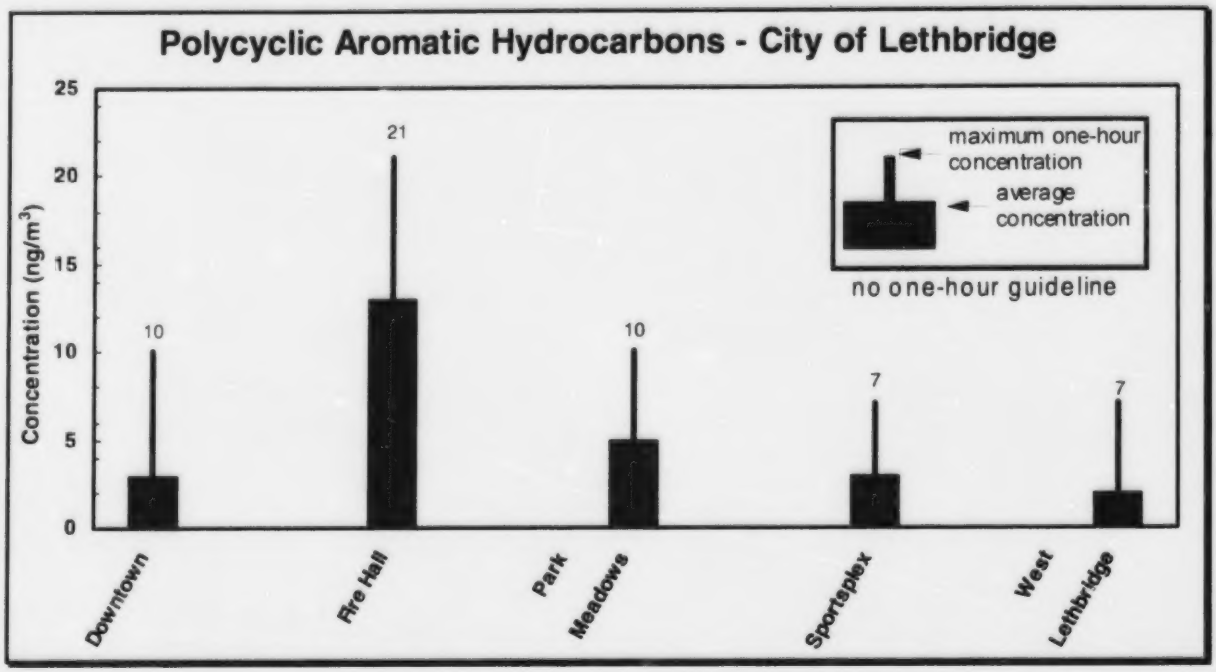
Total hydrocarbon concentrations in the background atmosphere range from 1.5 to 2.0 ppm.

Polycyclic Aromatic Hydrocarbons (PAHs)

max. one-hour concentration measured during survey	one-hour guideline
21 ng/m^3	no guideline

Polycyclic aromatic hydrocarbons (PAHs) are a class of chemicals that are contained in soot and smoke. There are more than 100 different PAHs with varying levels of toxicity. They are formed during the incomplete combustion of gasoline, diesel, oil, coal, wood, garbage or other organic substances. Tobacco smoke and charbroiled meats are common sources of PAHs. Other outdoor PAH sources include vehicle exhaust emissions, wood smoke from fireplaces, smoke from forest fires and industrial facilities. PAHs occur in the atmosphere in the vapour phase or attached to dust particles. The PAH monitoring instrument aboard the MAML will analyze only particulate bound PAHs.

The highest one-hour average PAH concentration was recorded at the Fire Hall site from 8:15 to 9:16 a.m. on July 20 with a value of 21 ng/m^3 (nanograms per cubic metre). The average PAH concentration for the entire monitoring period was also highest at the Fire Hall with an average concentration of 13 ng/m^3. Average PAH concentrations ranged from 2 to 5 ng/m^3 at the other monitoring sites. Higher PAH values at the Fire Hall site were likely due to vehicle exhaust emissions and emissions from a smoke course on February 24. Alberta does not have ambient air quality guidelines for total PAHs. This is because individual PAHs have different potential effects and therefore a single guideline for all PAHs would not be practical. Because PAHs are not routinely monitored on an hourly basis at permanent monitoring stations, PAH levels from this survey cannot be directly compared with other Alberta locations.



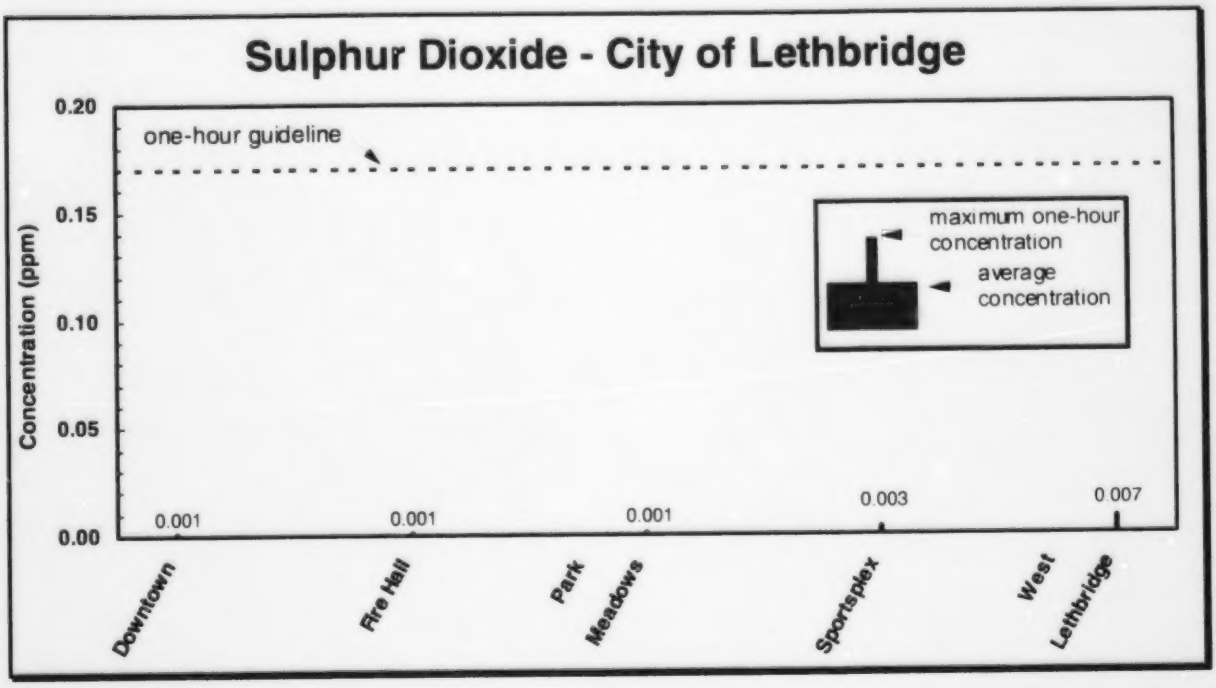
Sulphur Dioxide (SO_2)

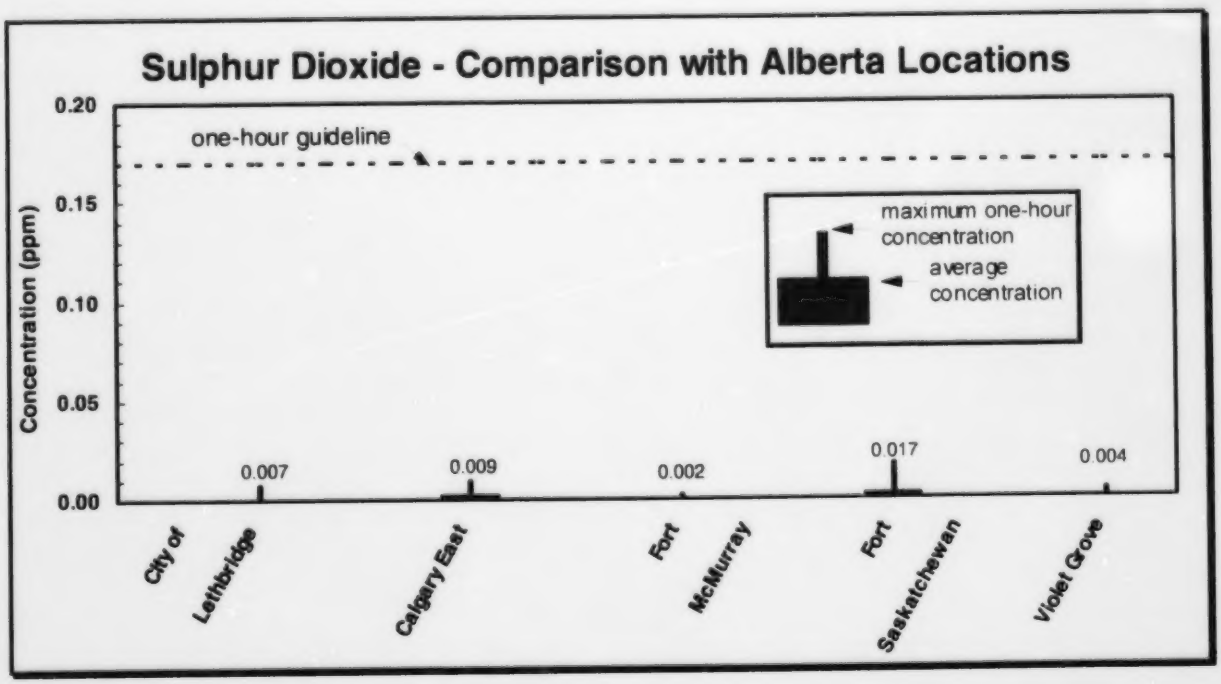
max. one-hour concentration measured during survey	one-hour guideline
0.007 ppm	0.170 ppm

Sulphur dioxide (SO_2) is a colourless gas with a pungent odour. In Alberta, the major sources of SO_2 are natural gas processing plants, oil sands facilities, and power plants. Other sources include gas plant flares, oil refineries, pulp and paper mills and fertilizer plants.

SO_2 levels were very low at all monitoring sites with a maximum value of 0.007 ppm measured at the West Lethbridge site from 11:38 a.m. to 12:39 p.m. (M.S.T.) on July 20. This value is 4% of the one-hour guideline for SO_2. Maximum one-hour concentrations of SO_2 were between 0.001 and 0.003 ppm at the remaining monitoring sites.

The overall average SO_2 concentration for the entire monitoring period in the Lethbridge survey was 0.001 ppm. The average SO_2 concentration in Lethbridge was lower than average values recorded at the Calgary East (0.003 ppm) and Fort Saskatchewan (0.003 ppm) monitoring stations. The maximum one-hour SO_2 concentration in Lethbridge (0.007 ppm) was also lower than maximum values recorded at the Calgary East (0.009 ppm) and Fort Saskatchewan (0.017 ppm) stations.


Sulphur Dioxide - City of Lethbridge
Concentration (ppm)
0.20
0.15
0.10
0.05
0.00
one-hour guideline
maximum one-hour concentration
average concentration
0.001
0.001
0.001
0.003
0.007
Downtown
Fire Hall
Park Meadows
Sportsplex
West Lethbridge


Sulphur Dioxide - Comparison with Alberta Locations
Concentration (ppm)
0.20
0.15
0.10
0.05
0.00
one-hour guideline
maximum one-hour concentration
average concentration
0.007
0.009
0.002
0.017
0.004
City of Lethbridge
Calgary East
Fort McMurray
Fort Saskatchewan
Violet Grove

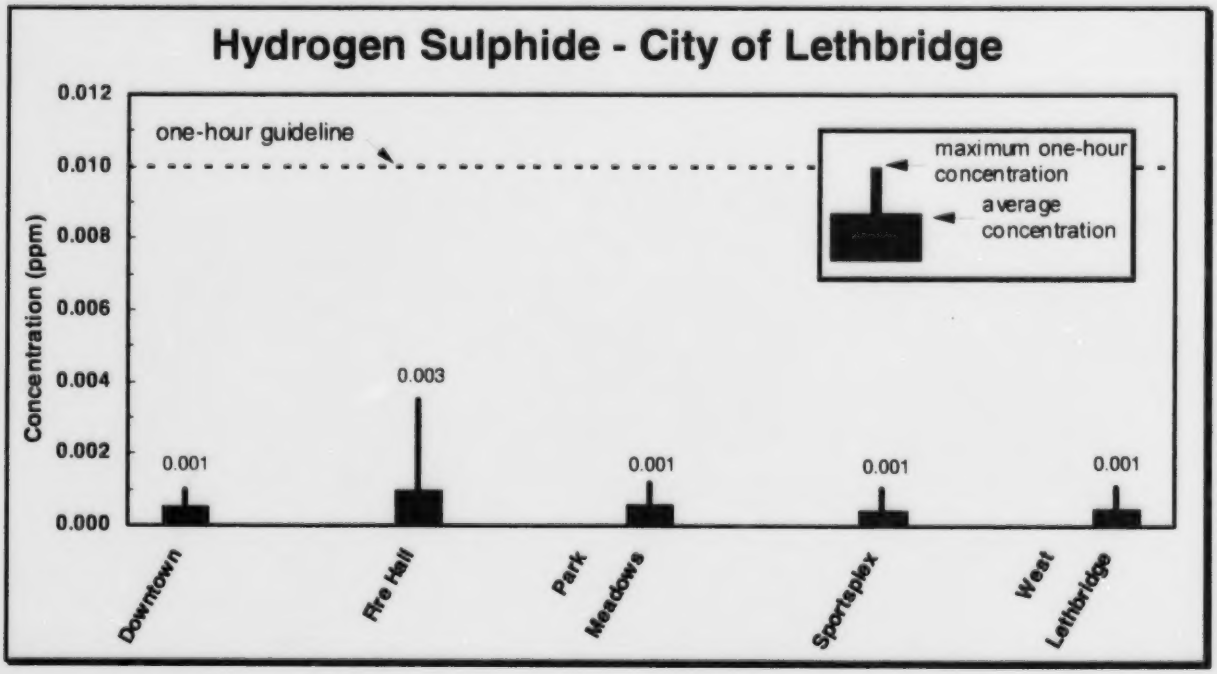
Hydrogen Sulphide and Total Reduced Sulphur (H_2S and TRS)

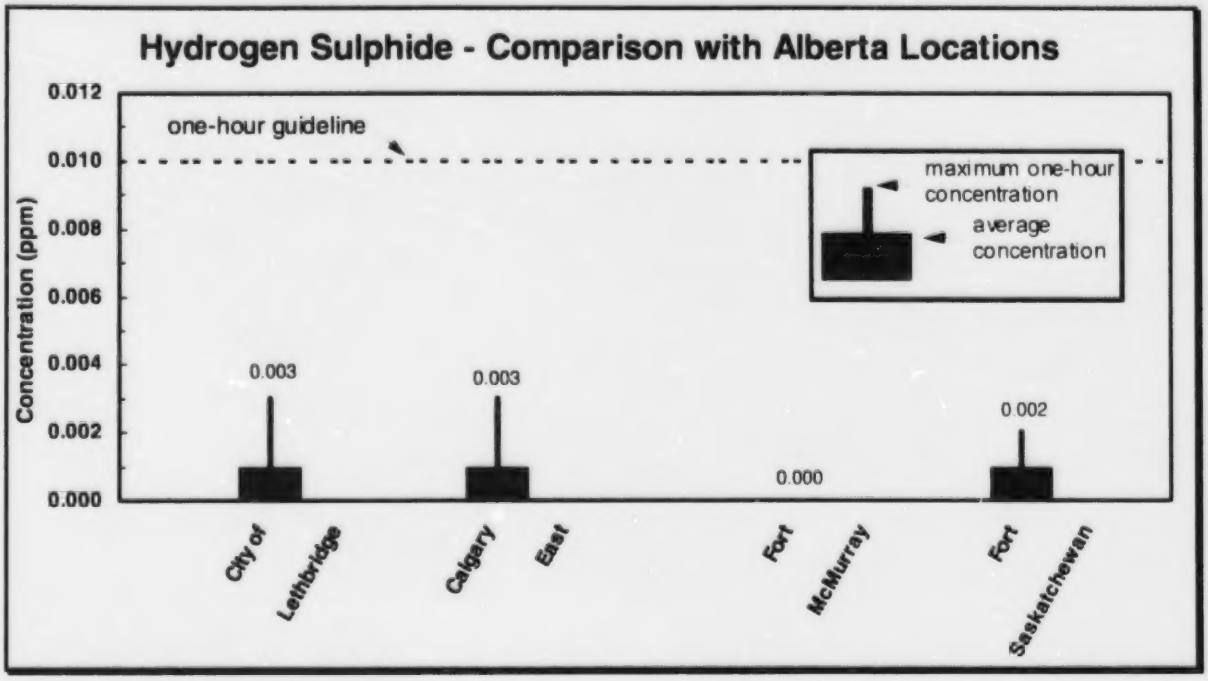
max. one-hour concentration measured during survey	one-hour guideline
H_2S = 0.003 ppm TRS = 0.001 ppm	0.010 ppm no guideline

Hydrogen sulphide (H_2S) is a colourless gas with a rotten egg odour. Total reduced sulphur (TRS) includes hydrogen sulphide, mercaptans, dimethyl sulphide, dimethyl disulphide and other sulphur compounds. Sulphur dioxide is not included in the determination of TRS. Industrial sources of H_2S and TRS include fugitive emissions (leakages) from petroleum refineries, tank farms for unrefined petroleum products, natural gas plants, petrochemical plants, oil sands plants, sewage treatment facilities, pulp and paper plants that use the Kraft pulping process, and animal feedlots. Natural sources of H_2S include sulphur hot springs, sloughs, swamps and lakes.

H_2S and TRS concentrations were at or below the detection limit of the monitoring instrument most of the time during the Lethbridge survey. The maximum one-hour H_2S concentration of 0.003 ppm was recorded on the morning of February 24 at the Fire Hall monitoring site. This value is 30% of the one-hour guideline for H_2S. H_2S at this site may have been caused by the smoke course conducted at the Fire Hall. One-hour average H_2S concentrations were 0.001 ppm or less for the remainder of the monitoring period.

The overall average H_2S concentration in the Lethbridge survey (0.001 ppm) was close to average values recorded at the Calgary East (0.001 ppm) and Fort Saskatchewan (0.001 ppm) monitoring stations for the same monitoring period. The maximum one-hour average H_2S concentration in Lethbridge (0.003 ppm) was also close to maximum values recorded at the Calgary East (0.003 ppm) and Fort Saskatchewan (0.002 ppm) stations. The overall average and maximum one-hour TRS concentrations in Lethbridge were 0.000 and 0.001 ppm, respectively. TRS was monitored only on May 11 and 12 during the Lethbridge survey. TRS is not routinely monitored at Alberta Environment monitoring stations.





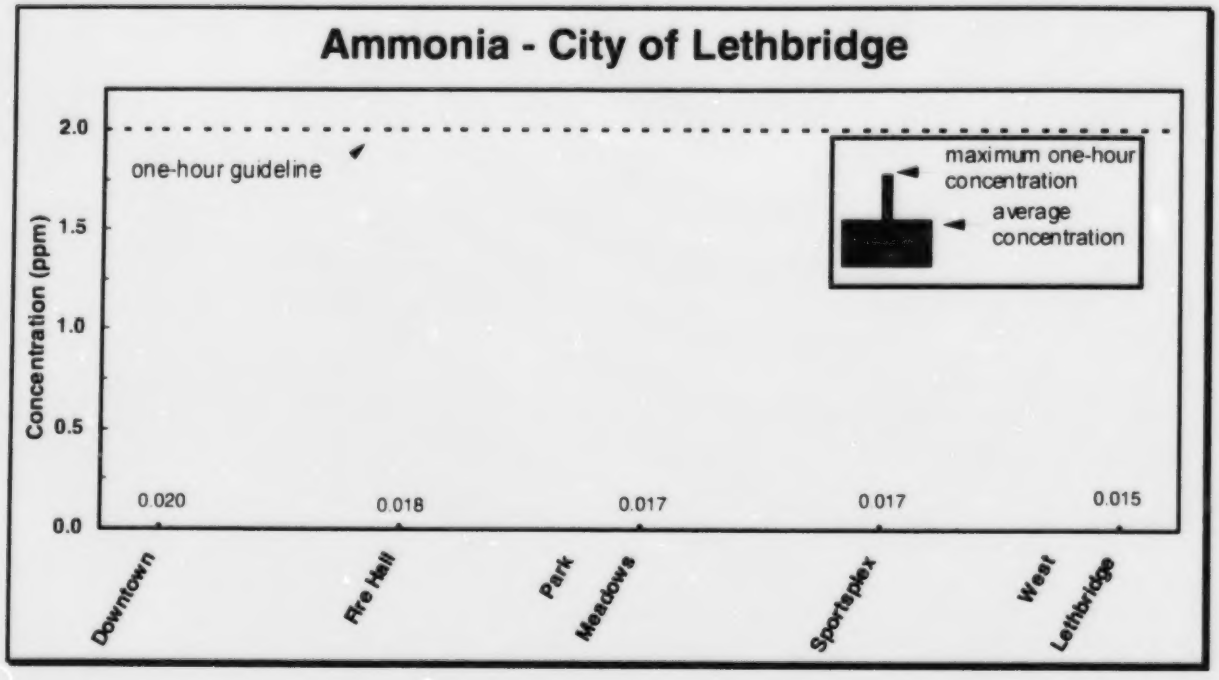
Ammonia (NH_3)

max. one-hour concentration measured during survey	one-hour guideline
0.020 ppm	2.0 ppm

Ammonia is a colourless gas with the well-known pungent odour found in household cleaners. NH_3 is produced both by natural and man-made sources. Some natural sources of NH_3 include the decay of plant material and animal waste. A small portion is also released during respiration. In Alberta, the fertilizer industry is the main industrial source of NH_3. The industry produces synthetic NH_3 for either direct application to soil as a fertilizer, or as a raw material for use in the production of other high nitrogen fertilizer products. The other major source of NH_3 is commercial feedlots, specifically from their large amounts of animal waste.

The highest one-hour average NH_3 concentration detected during the Lethbridge survey (0.020 ppm) was measured at the Downtown site from 10:32 a.m. to 11:32 a.m. (M.S.T.) on July 20. The concentration recorded during this time period was 1% of the one-hour guideline for ammonia. Maximum one-hour average NH_3 concentrations were consistent at all five sites, ranging from 0.015 to 0.020 ppm. Ammonia concentrations at these levels would likely not be detected as an odour.

Average and maximum one-hour NH_3 values in the Lethbridge survey were 0.006 and 0.020 ppm, respectively. Average and maximum one-hour NH_3 values at the Fort Saskatchewan station for the same time period were 0.003 and 0.008 ppm, respectively. NH_3 is not continuously monitored by Alberta Environment at any other monitoring stations.


Ammonia - City of Lethbridge
Concentration (ppm)
2.0
1.5
1.0
0.5
0.0
one-hour guideline
maximum one-hour concentration
average concentration
0.020
0.018
0.017
0.017
0.015
Downtown
Fire Hall
Park Meadows
Sportsplex
West Lethbridge

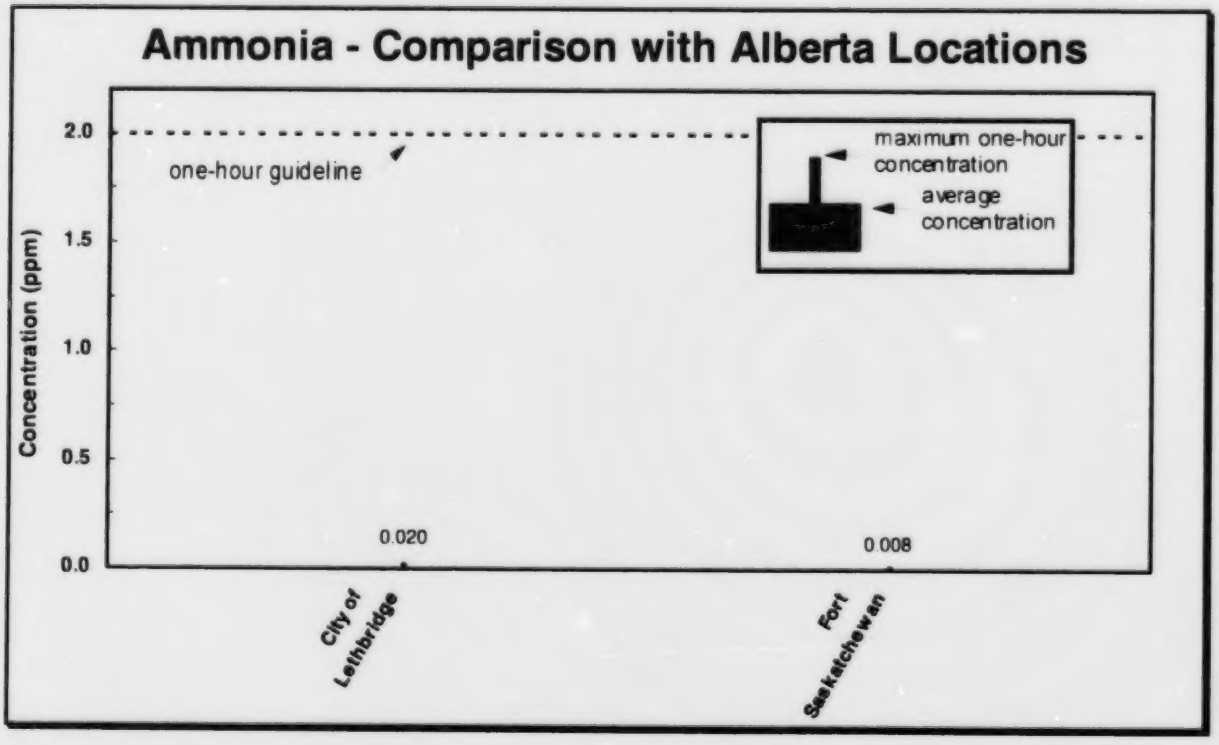

Ammonia - Comparison with Alberta Locations
Concentration (ppm)
2.0
1.5
1.0
0.5
0.0
one-hour guideline
maximum one-hour concentration
average concentration
0.020
0.008
City of Lethbridge
Fort Saskatchewan

Table 1 shows **overall average** air quality parameter concentrations at individual monitoring locations in Lethbridge.

Table 1: Overall Average Air Quality Parameter Concentrations at each Site in Lethbridge

Monitoring Location	CO (ppm)	O_3 (ppm)	THC (ppm)	CH_4 (ppm)	RHC (ppm)	SO_2 (ppm)	NO (ppm)	NO_2 (ppm)	NO_x (ppm)	NH_3 (ppm)	TRS (ppm)	H_2S (ppm)	TSP (ug/m^3)	PM_{10} (ug/m^3)	$PM_{2.5}$ (ug/m^3)	PAH (ng/m^3)
Downtown	0.2	0.046	2.0	1.7	0.2	0.000	0.001	0.003	0.004	0.006	0.000	0.001	23	16	3	3
Fire Hall	0.5	0.036	2.0	1.7	0.2	0.000	0.009	0.008	0.017	0.006	0.000	0.001	79	59	28	13
Park Meadows	0.3	0.045	2.0	1.6	0.2	0.000	0.002	0.003	0.005	0.006	0.000	0.001	24	15	2	5
Sportsplex	0.2	0.039	2.0	1.7	0.2	0.001	0.002	0.003	0.005	0.006	0.000	0.000	16	10	2	3
West Lethbridge	0.2	0.046	1.9	1.6	0.2	0.001	0.001	0.002	0.003	0.005	0.000	0.001	19	12	2	2
Overall Average	**0.3**	**0.042**	**2.0**	**1.7**	**0.2**	**0.001**	**0.003**	**0.004**	**0.007**	**0.006**	**0.000**	**0.001**	**32**	**23**	**7**	**5**

Table 2 shows **maximum one-hour** air quality parameter concentrations at individual monitoring locations in Lethbridge.

Table 2: Maximum One-hour Air Quality Parameter Concentrations at each Site in Lethbridge

Monitoring Location	CO (ppm)	O_3 (ppm)	THC (ppm)	CH_4 (ppm)	RHC (ppm)	SO_2 (ppm)	NO (ppm)	NO_2 (ppm)	NO_x (ppm)	NH_3 (ppm)	TRS (ppm)	H_2S (ppm)	TSP (ug/m^3)	PM_{10} (ug/m^3)	$PM_{2.5}$ (ug/m^3)	PAH (ng/m^3)
Downtown	0.6	0.058	2.1	1.8	0.3	0.001	0.004	**0.016**	0.020	**0.020**	0.000	0.001	94	70	15	10
Fire Hall	**2.4**	0.051	**2.2**	1.8	**0.4**	0.001	**0.026**	**0.016**	**0.042**	0.018	0.000	**0.003**	**405**	**363**	**294**	**21**
Park Meadows	0.6	**0.062**	2.1	1.8	0.3	0.001	0.006	0.007	0.010	0.017	0.000	0.001	75	51	7	10
Sportsplex	0.4	0.060	**2.2**	**1.9**	0.3	0.003	0.006	0.006	0.011	0.017	**0.001**	0.001	43	29	4	7
West Lethbridge	0.5	0.058	2.1	1.8	0.3	**0.007**	0.004	0.013	0.017	0.015	0.000	0.001	55	40	6	7
One-Hour Maximum	**2.4**	**0.062**	**2.2**	**1.9**	**0.4**	**0.007**	**0.026**	**0.016**	**0.042**	**0.020**	**0.001**	**0.003**	**405**	**363**	**294**	**21**
One-Hour Guideline	**13.0**	**0.082**	**n/a**	**n/a**	**n/a**	**0.170**	**n/a**	**0.210**	**n/a**	**2.0**	**n/a**	**0.010**	**n/a**	**n/a**	**n/a**	**n/a**

n/a No one hour guideline

Table 3 shows **peak five-minute** air quality parameter concentrations at individual monitoring locations in Lethbridge.

Table 3: Peak Five-Minute Air Quality Parameter Concentrations at each Site in Lethbridge

Monitoring Location	CO (ppm)	O_3 (ppm)	THC (ppm)	CH_4 (ppm)	RHC (ppm)	SO_2 (ppm)	NO (ppm)	NO_2 (ppm)	NO_x (ppm)	NH_3 (ppm)	TRS (ppm)	H_2S (ppm)	TSP (ug/m^3)	PM_{10} (ug/m^3)	$PM_{2.5}$ (ug/m^3)	PAH (ng/m^3)
Downtown	0.8	0.060	2.2	1.8	0.4	0.008	0.031	0.021	0.044	0.021	0.000	0.002	290	225	50	5
Fire Hall	**3.1**	0.063	**2.5**	1.8	**0.6**	0.002	**0.043**	**0.039**	**0.074**	**0.022**	0.000	**0.009**	**2572**	**2493**	**2247**	**50**
Park Meadows	0.8	**0.064**	2.2	1.8	0.4	0.002	0.009	0.012	0.016	0.021	0.000	0.002	100	66	8	28
Sportsplex	0.6	0.061	2.3	**2.0**	0.4	**0.014**	0.013	0.024	0.026	0.021	**0.001**	0.002	76	56	8	21
West Lethbridge	0.9	0.059	2.2	1.8	0.3	0.009	0.008	0.018	0.024	0.016	0.000	0.002	138	95	11	5
Five-Minute Peak	**3.1**	**0.064**	**2.5**	**2.0**	**0.6**	**0.014**	**0.043**	**0.039**	**0.074**	**0.022**	**0.001**	**0.009**	**2572**	**2493**	**2247**	**50**

Table 4 shows **overall average** air quality parameter concentrations at all monitoring locations in Lethbridge for the entire monitoring period compared with other locations in Alberta.

Table 4: Overall Average Air Quality Parameter Concentrations at Other Locations in Alberta

Monitoring Location	CO (ppm)	O_3 (ppm)	THC (ppm)	CH_4 (ppm)	RHC (ppm)	SO_2 (ppm)	NO (ppm)	NO_2 (ppm)	NO_X (ppm)	NH_3 (ppm)	TRS (ppm)	H_2S (ppm)	TSP (ug/m^3)	PM_{10} (ug/m^3)	$PM_{2.5}$ (ug/m^3)	PAH (ng/m^3)
Lethbridge	0.3	0.042	2.0	1.7	0.2	0.001	0.003	0.004	0.007	0.006	0.000	0.001	32	23	7	5
Calgary Central	1.0	0.020	2.1	no data			0.026	0.031	0.056	no data				23	10	no data
Calgary East	0.6	0.026	2.1	no data		0.003	0.028	0.024	0.052	no data		0.001	no data			
Calgary Northwest	0.5	0.033	2.0	no data			0.007	0.013	0.020				no data			
Fort McMurray	0.3	0.027	2.0	no data		0.000	0.003	0.007	0.011	no data		0.000	no data		7	no data
Fort Saskatchwan	0.5	0.032	1.8	no data		0.003	0.011	0.013	0.024	0.003		0.001	no data			
Violet Grove ***	no data	0.041	no data			0.001	0.001	0.002	0.003				no data			
High Tower Ridge ****	no data	0.048	no data													

*** The Violet Grove station is operated by the West Central Airshed Society and located 10 km southwest of Drayton Valley

**** The High Tower Ridge station is operated by the West Central Airshed Society and located 65 km west-northwest of Hinton

Table 5 shows **maximum one-hour** air quality parameter concentrations at all monitoring locations in Lethbridge for the entire monitoring period compared with other locations in Alberta.

Table 5: Maximum One-Hour Average Air Quality Parameter Concentrations at Other Locations in Alberta

Monitoring Location	CO (ppm)	O_3 (ppm)	THC (ppm)	CH_4 (ppm)	RHC (ppm)	SO_2 (ppm)	NO (ppm)	NO_2 (ppm)	NO_X (ppm)	NH_3 (ppm)	TRS (ppm)	H_2S (ppm)	TSP (ug/m^3)	PM_{10} (ug/m^3)	$PM_{2.5}$ (ug/m^3)	PAH (ng/m^3)
Lethbridge	2.4	0.062	2.2	1.9	0.4	0.007	0.026	0.016	0.042	0.020	0.001	0.003	405	363	294	21
Calgary Central	3.1	0.040	2.9	no data			0.194	0.070	0.255	no data				52	19	no data
Calgary East	3.1	0.050	3.0	no data		0.009	0.220	0.067	0.250	no data		0.003	no data			
Calgary Northwest	2.5	0.056	2.7	no data			0.121	0.044	0.148				no data			
Fort McMurray	1.0	0.054	2.1	no data		0.002	0.021	0.033	0.052	no data		0.000	no data		20	no data
Fort Saskatchwan	2.1	0.058	2.8	no data		0.017	0.143	0.060	0.159	0.008	no data	0.002	no data			
Violet Grove ***	no data	0.070	no data			0.004	0.003	0.007	0.010				no data			
High Tower Ridge ****	no data	0.075	no data													
One-Hour Guidline	**13.0**	**0.082**	**n/a**	**n/a**	**n/a**	**0.170**	**n/a**	**0.210**	**n/a**	**2.0**	**n/a**	**0.010**	**n/a**	**n/a**	**n/a**	**n/a**

n/a No one hour guideline

*** The Violet Grove station is operated by the West Central Airshed Society and located 10 km southwest of Drayton Valley

**** The High Tower Ridge station is operated by the West Central Airshed Society and located 65 km west-northwest of Hinton

Table 6 shows **one-hour average** air quality parameter concentrations and weather conditions on September and February survey days at each monitoring location in Lethbridge.

Table 6: One-hour Average Air Quality Parameter Concentrations and Weather Conditions at Each Monitoring Site in the City of Lethbridge (September 23 and 24, 1998 and February 23 and 24, 1999)

Monitoring Location	Date	Time (M.S.T.)	CO (ppm)	O3 (ppm)	THC (ppm)	CH4 (ppm)	RHC (ppm)	SO2 (ppm)	NO (ppm)	NO2 (ppm)	NO_x (ppm)	NH3 (ppm)	TRS (ppm)	H2S (ppm)	TSP ($\mu g/m^3$)	PM10 ($\mu g/m^3$)	PM2.5 ($\mu g/m^3$)	PAH (ng/m^3)	Temp (Deg C)	WSP (km/h)	WDR
Sportsplex	23-Sep-98	7:35 a.m. to 8:40 a.m.	0.4	0.014	2.1	1.8	0.2	0.000	0.006	0.005	0.011	0.011	no data	0.000	22	17	3	no data	11	7	SW
Downtown		10:16 a.m. to 11:17 a.m.	0.4	0.035	2.0	1.8	0.1	0.001	0.004	0.004	0.007	0.013	no data	0.000	18	13	2	no data	20	11	SW
West Lethbridge		11:36 a.m. to 12:59 p.m.	0.3	0.047	2.0	1.8	0.1	0.001	0.000	0.002	0.001	0.010	no data	0.000	14	10	1	no data	22	13	SE
Park Meadows		1:21 p.m. to 2:23 p.m.	0.6	0.044	2.0	1.8	0.1	0.001	0.001	0.004	0.004	0.007	no data	0.000	24	15	2	no data	24	9	SW
Sportsplex		2:38 p.m. to 3:35 p.m.	0.3	0.046	1.9	1.8	0.1	0.001	0.000	0.002	0.002	0.006	no data	0.000	11	7	1	no data	25	18	SW
Park Meadows		5:00 p.m. to 5:58 p.m.	0.3	0.042	1.9	1.7	0.1	0.000	0.000	0.003	0.004	0.005	no data	0.000	25	16	2	no data	22	11	SW
Downtown		6:11 p.m. to 7:10 p.m.	0.3	0.036	1.9	1.7	0.1	0.000	0.001	0.007	0.008	0.005	no data	0.000	17	11	2	no data	20	19	SW
West Lethbridge		7:18 p.m. to 8:18 p.m.	0.3	0.037	1.9	1.7	0.1	0.001	0.001	0.002	0.003	0.004	no data	0.000	26	18	3	no data	17	12	W
Sportsplex	24-Sep-98	7:36 a.m. to 8:42 a.m.	0.3	0.017	2.0	1.8	0.2	0.000	0.004	0.004	0.008	0.002	no data	0.000	no data				10	7	NW-SE
Fire Hall		8:58 a.m. to 9:58 a.m.	**2.4**	0.026	2.1	1.8	0.2	0.001	0.010	0.005	0.015	0.006	no data	0.001	no data				12	7	SW-E
Park Meadows		10:31 a.m. to 11:38 a.m.	0.3	0.032	2.0	1.8	0.2	0.000	0.001	0.002	0.002	0.010	no data	0.001	29	18	2	no data	15	6	W-SE
Downtown		12:20 p.m. to 1:19 p.m.	0.3	0.036	2.0	1.8	0.1	0.000	0.000	0.004	0.003	0.011	no data	0.001	32	20	3	no data	18	7	E
West Lethbridge		1:25 p.m. to 2:22 p.m.	0.5	0.037	2.0	1.7	0.1	0.000	0.001	0.005	0.005	0.010	no data	0.001	31	19	3	no data	18	7	SE
Sportsplex		2:34 p.m. to 3:32 p.m.	0.3	0.039	2.0	1.7	0.1	0.001	0.001	0.006	0.005	0.009	no data	0.001	43	29	4	no data	18	10	SW
Fire Hall		3:45 p.m. to 4:43 p.m.	0.3	0.038	2.0	1.7	0.1	0.000	0.000	0.005	0.003	0.009	no data	0.001	100	64	7	no data	17	10	N
Park Meadows		4:49 p.m. to 5:49 p.m.	0.4	0.032	2.0	1.8	0.2	0.001	0.000	0.007	0.005	0.010	no data	0.001	75	51	7	no data	16	10	NE
Downtown		6:02 p.m. to 7:01 p.m.	0.6	0.019	2.1	1.8	0.2	0.001	0.004	**0.016**	0.020	0.008	no data	0.001	81	52	7	no data	15	13	NE
West Lethbridge		7:08 p.m. to 8:09 p.m.	0.5	0.019	2.0	1.7	0.2	0.001	0.004	0.013	0.017	0.008	no data	0.001	55	40	6	no data	13	16	NE
Sportsplex	23-Feb-99	8:31 a.m. to 9:32 a.m.	0.0	0.053	2.1	1.7	0.2	0.000	0.001	0.000	0.001	0.001	no data	0.001	19	11	1	2	4	39	W
Fire Hall		9:43 a.m. to 10:43 a.m.	0.0	0.051	2.1	1.7	0.3	0.000	0.003	0.003	0.006	0.001	no data	0.001	140	97	16	6	4	28	W
Park Meadows		10:48 a.m. to 11:48 a.m.	0.0	0.053	2.1	1.6	0.3	0.000	0.001	0.001	0.002	0.002	no data	0.001	29	19	3	3	6	28	W
Downtown		11:58 a.m. to 12:57 p.m.	0.0	0.054	2.1	1.7	0.2	0.000	0.000	0.000	0.000	0.001	no data	0.001	94	70	15	2	6	47	W
West Lethbridge		1:02 p.m. to 2:01 p.m.	0.0	0.053	2.1	1.7	0.3	0.000	0.000	0.000	0.000	0.001	no data	0.000	17	9	1	1	6	50	W
Sportsplex		2:11 p.m. to 3:12 p.m.	0.0	0.053	2.1	1.7	0.2	0.000	0.001	0.000	0.001	0.001	no data	0.000	6	4	1	2	6	36	SW
Fire Hall		3:22 p.m. to 4:28 p.m.	0.1	0.048	2.1	1.7	0.3	0.000	0.005	0.005	0.010	0.001	no data	0.001	25	15	2	10	5	30	SW
Park Meadows		4:32 p.m. to 5:31 p.m.	0.0	0.049	2.1	1.7	0.3	0.000	0.003	0.003	0.006	0.002	no data	0.001	14	10	1	5	4	21	W
Downtown		5:38 p.m. to 6:38 p.m.	0.0	0.049	2.1	1.7	0.3	0.000	0.000	0.001	0.002	0.001	no data	0.001	8	6	1	2	2	21	W
West Lethbridge		6:41 p.m. to 7:43 p.m.	0.0	0.047	1.9	1.6	0.2	0.000	0.000	0.000	0.000	0.001	no data	0.000	10	8	1	2	2	22	W
Sportsplex	24-Feb-99	8:35 a.m. to 9:36 a.m.	0.1	0.029	2.1	1.7	0.2	0.000	0.005	0.005	0.010	0.004	no data	0.000	24	15	2	4	5	9	S
Fire Hall *		9:46 a.m. to 10:50 a.m.	0.8	0.024	**2.2**	1.7	**0.4**	0.001	**0.026**	**0.016**	**0.042**	0.006	no data	**0.003**	**405**	**363**	**294**	15	10	12	S
Park Meadows		11:09 a.m. to 12:08 p.m.	0.3	0.043	2.0	1.6	0.2	0.001	0.006	0.003	0.008	0.004	no data	0.000	41	25	3	10	13	21	SW
Downtown		12:18 p.m. to 1:19 p.m.	0.2	0.046	1.9	1.6	0.2	0.001	0.001	0.000	0.001	0.002	no data	0.000	12	9	1	2	14	27	W
West Lethbridge		1:23 p.m. to 2:23 p.m.	0.1	0.046	1.9	1.6	0.2	0.001	0.000	0.000	0.000	0.001	no data	0.000	11	7	1	1	13	27	SW
Sportsplex		2:34 p.m. to 3:34 p.m.	0.2	0.048	2.0	1.6	0.2	0.001	0.003	0.000	0.003	0.002	no data	0.000	20	12	2	2	14	26	SW
Fire Hall		3:47 p.m. to 4:46 p.m.	0.4	0.040	2.0	1.6	0.2	0.001	0.010	0.006	0.016	0.003	no data	0.000	62	38	5	9	13	15	SW
Park Meadows		4:51 p.m. to 5:50 p.m.	0.4	0.043	2.0	1.6	0.2	0.001	0.005	0.003	0.008	0.003	no data	0.000	30	20	3	6	11	16	SW
Downtown		5:59 p.m. to 6:59 p.m.	0.2	0.041	1.9	1.6	0.1	0.001	0.001	0.004	0.005	0.000	no data	0.000	18	12	2	10	10	12	SW
West Lethbridge		7:06 p.m. to 8:08 p.m.	0.2	0.041	1.9	1.6	0.2	0.001	0.001	0.001	0.003	0.001	no data	0.000	26	19	2	7	7	9	SW
one-hour guideline			13.0	0.082	n/a	n/a	n/a	0.170	n/a	0.210	n/a	2.0	n/a	0.010	n/a	n/a	n/a	n/a	n/a	n/a	n/a

no data - indicates that analyzer was not operational for indicated time period n/a - No one hour guideline * High particulate concentrations were caused by a smoke course conducted at the Fire Hall

List of Air Quality and Weather Parameters

- CO - carbon monoxide
- O_3 - ozone
- THC - total hydrocarbons
- CH_4 - methane
- RHC - reactive hydrocarbons
- SO_2 - sulphur dioxide
- NO - nitric oxide
- NO_2 - nitrogen dioxide
- NO_x - total oxides of nitrogen
- NH_3 - ammonia
- TRS - total reduced sulphur
- H_2S - hydrogen sulphide
- PAH - polycyclic aromatic hydrocarbons
- TSP - total suspended particulates
- PM_{10} - inhalable particulates
- $PM_{2.5}$ - respirable particulates
- Temp - ambient temperature
- WSP - wind speed
- WDR - wind direction

Table 7 shows **one-hour average** air quality parameter concentrations and weather conditions on May and July survey days at each monitoring location in Lethbridge.

Table 7: One-hour Average Air Quality Parameter Concentrations and Weather Conditions at Each Monitoring Site in the City of Lethbridge (May 11 and 12, and July 19 and 20, 1999)

Monitoring Location	Date	Time (M.S.T.)	CO (ppm)	O3 (ppm)	THC (ppm)	CH4 (ppm)	RHC (ppm)	SO2 (ppm)	NO (ppm)	NO2 (ppm)	NO_x (ppm)	NH3 (ppm)	TRS (ppm)	H2S (ppm)	TSP ($\mu g/m^3$)	PM10 ($\mu g/m^3$)	PM2.5 ($\mu g/m^3$)	PAH (ng/m^3)	Temp (Deg C)	WSP (km/h)	WDR
Sportsplex	11-May-99	7:29 a.m. to 8:30 a.m.	0.1	0.024	2.2	1.9	0.2	0.001	0.004	0.005	0.009	0.011	0.001	0.001	no data			7	0	9	SW
Fire Hall		8:40 a.m. to 9:40 a.m.	0.1	0.035	2.0	1.7	0.2	0.000	0.008	0.004	0.013	0.013	0.000	0.001	11	8	2	9	4	9	SW
Park Meadows		9:45 a.m. to 10:45 a.m.	0.2	0.047	2.0	1.7	0.2	0.001	0.003	0.006	0.011	0.000	0.000	0.001	10	7	1	3	7	9	N
Downtown		10:53 a.m. to 11:53 a.m.	0.2	0.057	1.9	1.6	0.2	0.001	0.002	0.001	0.003	0.011	0.000	0.001	6	4	1	2	9	13	NW
West Lethbridge		11:59 a.m. to 1:00 p.m.	0.2	0.058	1.9	1.6	0.2	0.001	0.001	0.002	0.003	0.007	0.000	0.001	7	4	1	2	11	12	N
Sportsplex		1:10 p.m. to 2:10 p.m.	0.1	0.060	1.9	1.6	0.2	0.002	0.002	0.003	0.005	0.007	0.000	0.001	8	5	1	3	12	17	N
Fire Hall		2:21 p.m. to 3:20 p.m.			no data			0.001		no data			0.000	0.001		no data			13	14	N
Park Meadows		3:25 p.m. to 4:26 p.m.	0.1	**0.062**	1.8	1.6	0.2	0.001	0.000	0.002	0.002	0.007	0.000	0.001	8	6	1	2	12	16	N
Downtown		4:34 p.m. to 5:34 p.m.	0.1	0.058	1.9	1.6	0.2	0.001	0.001	0.006	0.006	0.006	0.000	0.001	10	7	2	3	12	14	N
West Lethbridge		5:39 p.m. to 6:40 p.m.	0.3	0.057	1.9	1.6	0.2	0.001	0.000	0.004	0.005	0.007	0.000	0.001	9	6	1	3	12	11	E
Sportsplex	12-May-99	7:02 a.m. to 8:13 a.m.	0.2	0.025	2.0	1.7	0.2	0.000	0.003	0.005	0.008	0.006	0.000	0.001	17	11	2	3	6	4	SE
Fire Hall		8:21 a.m. to 9:24 a.m.	0.6	0.021	2.0	1.7	0.3	0.001	0.013	0.012	0.024	0.009	0.000	0.001	39	24	3	15	8	4	SW
Park Meadows		9:28 a.m. to 10:30 a.m.	0.5	0.042	1.9	1.6	0.2	0.000	0.004	0.005	0.009	0.007	0.000	0.001	27	16	2	6	10	6	N
Downtown		10:39 a.m. to 11:40 a.m.	0.3	0.054	1.9	1.6	0.2	0.001	0.001	0.003	0.004	0.006	0.000	0.001	24	15	2	2	12	8	N
West Lethbridge		11:45 a.m. to 12:45 p.m.	0.4	0.055	1.8	1.6	0.2	0.000	0.001	0.003	0.003	0.011	0.000	0.001	23	13	2	3	13	6	SW
Sportsplex		12:56 p.m. to 1:57 p.m.	0.3	0.054	1.8	1.5	0.2	0.000	0.000	0.002	0.002	0.007	0.000	0.001	8	5	1	2	12	13	SW
Fire Hall		2:14 p.m. to 3:27 p.m.	0.5	0.044	1.8	1.5	0.2	0.001	0.008	0.013	0.020	0.004	0.000	0.001	26	18	3	9	13	8	V*
Park Meadows		3:32 p.m. to 4:33 p.m.	0.3	0.052	1.8	1.5	0.2	0.000	0.003	0.004	0.006	0.003	0.000	0.001	16	10	1	4	15	15	SW
Downtown		4:43 p.m. to 5:34 p.m.	0.2	0.057	1.8	1.5	0.2	0.000	0.000	0.001	0.001	0.001	0.000	0.000	8	5	1	2	15	26	SW
West Lethbridge		5:48 p.m. to 7:03 p.m.	0.4	0.047	1.8	1.6	0.2	0.001	0.001	0.003	0.004	0.002	0.000	0.001	14	9	2	2	11	14	W
Sportsplex	19-Jul-99	7:45 a.m. to 8:45 a.m.	0.1	0.032	1.9	1.7	0.1	0.000	0.001	0.001	0.001	0.000	no data	0.000	10	6	1	2	20	9	S
Fire Hall		8:59 a.m. to 9:58 a.m.	0.3	0.031	1.9	1.7	0.2	0.000	0.009	0.009	0.017	0.001	no data	0.000	34	19	2	16	22	14	S
Park Meadows		10:02 a.m. to 11:02 a.m.	0.2	0.044	1.9	1.6	0.2	0.000	0.001	0.002	0.002	0.001	no data	0.000	11	7	1	5	25	11	SW
Downtown		11:11 a.m. to 12:16 p.m.	0.2	0.048	1.9	1.6	0.2	0.000	0.000	0.002	0.001	0.000	no data	0.000	8	5	1	2	25	29	SW
West Lethbridge		12:22 p.m. to 1:21 p.m.	0.2	0.049	1.8	1.6	0.2	0.000	0.000	0.000	0.000	0.000	no data	0.000	8	5	1	1	26	24	SW
Sportsplex		1:35 p.m. to 2:37 p.m.	0.2	0.050	1.8	1.6	0.2	0.000	0.000	0.000	0.000	0.000	no data	0.000	7	5	1	2	26	20	SW
Fire Hall		2:49 p.m. to 3:48 p.m.	0.4	0.043	1.9	1.6	0.2	0.000	0.006	0.010	0.015	0.001	no data	0.000	26	15	2	18	27	21	S
Park Meadows		3:53 p.m. to 4:52 p.m.	0.2	0.050	1.9	1.6	0.2	0.000	0.001	0.003	0.003	0.002	no data	0.000	12	7	1	6	27	14	SW
Downtown		5:01 p.m. to 6:01 p.m.	0.2	0.052	1.9	1.6	0.2	0.000	0.000	0.001	0.000	0.001	no data	0.000	9	6	1	2	26	25	SW
West Lethbridge		6:07 p.m. to 7:09 p.m.	0.2	0.045	1.8	1.6	0.2	0.000	0.000	0.001	0.000	0.002	no data	0.000	15	10	1	1	25	17	SW
Sportsplex	20-Jul-99	7:05 a.m. to 8:06 a.m.	0.0	0.027		no data		0.003	0.001	0.003	0.004	0.017	no data	0.000	13	8	1	3	19	6	SW
Fire Hall		8:15 a.m. to 9:16 a.m.	0.2	0.022		no data		0.000	0.013	0.012	0.025	0.018	no data	0.001	57	34	4	21	22	9	S
Park Meadows		9:21 a.m. to 10:22 a.m.	0.1	0.032		no data		0.000	0.003	0.007	0.010	0.017	no data	0.001	13	9	1	5	23	6	S
Downtown		10:32 a.m. to 11:32 a.m.	0.1	0.040		no data		0.001	0.001	0.002	0.002	**0.020**	no data	0.001	14	9	1	2	27	7	SW
West Lethbridge		11:38 a.m. to 12:39 p.m.	0.2	0.050		no data		**0.007**	0.000	0.001	0.000	0.015	no data	0.001	7	5	1	1	28	10	SW
Sportsplex		12:50 p.m. to 1:54 p.m.	0.1	0.051	1.9	1.5	0.3	0.000	0.001	0.001	0.002	0.015	no data	0.001	11	7	1	2	28	9	S
Fire Hall		2:11 p.m. to 3:10 p.m.	0.2	0.046	1.9	1.5	0.3	0.000	0.005	0.008	0.013	0.009	no data	0.001	28	17	2	13	30	13	S
Park Meadows		3:15 p.m. to 4:16 p.m.	0.2	0.053	1.9	1.5	0.3	0.000	0.001	0.003	0.003	0.006	no data	0.001	14	8	1	3	30	9	SW
Downtown		4:25 p.m. to 5:26 p.m.	0.1	0.055	1.9	1.5	0.3	0.000	0.000	0.002	0.000	0.003	no data	0.001	13	8	1	2	30	10	SW
West Lethbridge		5:32 p.m. to 6:33 p.m.	0.1	0.053	1.8	1.5	0.2	0.000	0.000	0.001	0.000	0.001	no data	0.001	27	19	3	2	29	10	SW
one-hour guideline			**13.0**	**0.082**	**n/a**	**n/a**	**n/a**	**0.170**	**n/a**	**0.210**	**n/a**	**2.0**	**n/a**	**0.010**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

no data - Indicates that analyzer was not operational for indicated time period. n/a - No one hour guideline. *V - Indicates wind speed was light and from variable directions.

List of Air Quality and Weather Parameters

- CO - carbon monoxide
- O_3 - ozone
- THC - total hydrocarbons
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- RHC - reactive hydrocarbons
- SO_2 - sulphur dioxide
- NO - nitric oxide
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